



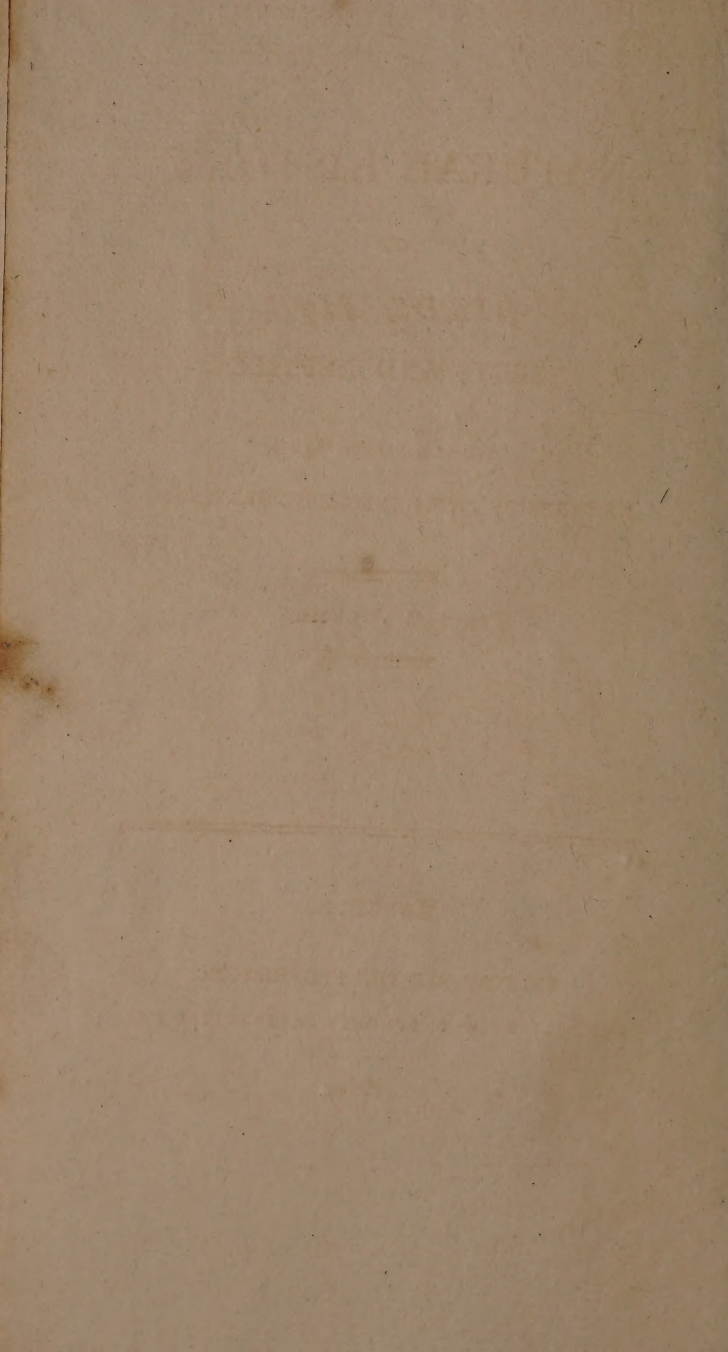
N. Hadley Junr.



John Marmaduke Teesdale.







NATURAL HISTORY

OF

BIRDS, FISH,
INSECTS AND REPTILES.

EMBELLISHED WITH
UPWARDS OF TWO HUNDRED ENGRAVINGS.

IN SIX VOLUMES

VOL V.

London :

PRINTED FOR THE PROPRIETOR;
AND SOLD BY H. D. SYMONDS PATERNOSTER-ROW.

1808.

NATURAL HISTORY

BIRDS, FISH

INSECTS AND REPTILES

ILLUSTRATED WITH

NUMEROUS OF TWO HUNDRED ENGRAVINGS



VOL. 7

LONDON:

PRINTED FOR THE PROPRIETOR

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NATURAL HISTORY

OF

BIRDS, FISH, REPTILES, &c.

MULTIVALVE SHELL-FISH:

THE covering of the *Multivalve* shell-fish is so singularly formed, as not to give the least reason to suppose from its outward appearance, that it contains a living animal, and much less (when that fact is ascertained) that the animal within is capable of moving its unwieldy habitation with any degree of speed, and yet both are equally true. Of this class of shell-fish there are two kinds, the one which moves about, and the other which is nearly stationary. The first are generally denominated *echini*, or *sea-urchins*, though sometimes known by the name of *sea-eggs*; and the latter, *pholades*, or *file-fish*. These have been often admired for the facility with which they scoop out

VOL. V. B cavities

cavities in the hardest marble, and wherein they seek a place of security. There are many varieties in both these species, but a competent idea of the whole may be drawn from the following accurate description which has been given of the two principal.

“ To a slight view the sea-urchin may be
“ compared to the husk of a chesnut ; being
“ like it round, and with a number of bony
“ prickles standing out on every side. To ex-
“ hibit this extraordinary animal in every light :
“ if we could conceive a turnip stuck full of
“ pins on every side, and running upon those
“ pins with some degree of swiftness, we should
“ have some idea of this extraordinary creature.
“ The mouth is placed downwards ; the vent
“ above ; the shell is a hollow vase, resembling
“ a scooped apple ; and this filled with a soft,
“ muscular substance, through which the in-
“ testines wind from the bottom to the top.
“ The mouth, which is placed undermost, is
“ large and red, furnished with five sharp teeth,
“ which are easily discerned. The jaws are
“ strengthened by five small bones, in the cen-
“ tre of which is a small fleshy tongue ; and
“ from this the intestines make a winding of
“ five spines, round the internal sides of the
“ shell,

“ shell, ending at the top, where the excre-
“ ments are excluded. But what makes the
“ most extraordinary part of this animal’s con-
“ formation, are its horns and its spines, that
“ point from every part of the body, like the
“ horns of a snail, and that serve at once as
“ legs to move upon, as arms to feel with, and
“ as instruments of capture and defence. Be-
“ tween these horns it has also spines, that are
“ not endowed with such a share of motion.
“ The spines and the horns issue from every
“ part of its body ; the spines being hard and
“ prickly ; the horns being soft, longer than
“ the spines, and never seen except in the water.
“ They are put forward and withdrawn like the
“ horns of a snail, and are hid at the basis of
“ the spines, serving, as was said before, for
“ procuring food and motion. All this appa-
“ ratus, however, is only seen when the ani-
“ mal is hunting its prey at the bottom of the
“ water ; for a few minutes after it is taken,
“ all the horns are withdrawn into the body,
“ and most of the spines drop off.

“ It is generally said, that those animals
“ which have the greatest number of legs al-
“ ways move the slowest : but this animal is
“ an exception to the rule ; for though fur-
“ nished

“ nished with two thousand spines, and twelve
“ hundred horns, all serving for legs, and from
“ their number seeming to impede each other’s
“ motion, yet it runs with some share of swift-
“ ness at the bottom, and is sometimes no easy
“ matter to overtake it. It is often taken in
“ the ebb, by following it in shallow water,
“ either in an ozier basket, or simply with the
“ hand. Both the spines and the horns assist
“ its motion; and the animal is usually seen
“ running with the mouth downward.

“ Some kinds of this animal are pretty large,
“ and esteemed as good eating as the lobster;
“ and its eggs, which are of a deep red, are
“ considered as a very great delicacy. But of
“ most of them the flesh is indifferent; and
“ in all places, except the Mediterranean, they
“ are little sought for, except as objects of
“ curiosity.

“ The *acorn* shell-fish, the *thumb-footed* shell-
“ fish, and the *imaginary barnacle*, though near-
“ ly resembling the preceding in shape, are
“ very different as far as relates to motion.
“ These are fixed to one spot, and appear to
“ vegetate from a stalk. Indeed, to an inat-
“ tentive spectator, each actually appears to be
“ a kind of fungus that grows in the deep, des-
“ titute

titute of animal life as well as motion. But
 “ the enquirer will soon change his opinion;
 “ when he comes to observe this mushroom-
 “ like figure more minutely. He will then
 “ see that the animal residing within the shell
 “ has not only life, but some degree of vorac-
 “ ousness. They are seen adhering to every
 “ substance that is to be met with in the ocean;
 “ rocks, roots of trees, ships’ bottoms, whales;
 “ lobsters, and even crabs, like bunches of
 “ grapes clung to each other. ‘It is,’ says An-
 derson, in his History of Greenland, ‘amusing
 ‘ enough to behold their operations. They for
 ‘ some time remain motionless within their shell,
 ‘ but when the sea is calm they are seen open-
 ‘ ing the lid, and peeping about them. They
 ‘ then thrust out their long neck, look round
 ‘ them for some time, and then abruptly retreat
 ‘ back into their box, shut their lid, and lurk
 ‘ in darkness and security. Some people eat
 ‘ them, but they are in no great repute.

“ The *pholades* of all animals of the shelly
 “ tribe are the most wonderful, and most par-
 “ ticularly excite the attention of the curious
 “ observer. These animals are found in dif-
 “ ferent places; sometimes cloathed in their
 “ proper shell, at the bottom of the water;
 “ some-

“ sometimes concealed in lumps of marly earth;
“ and sometimes lodged, shell and all, in the
“ body of the hardest marble. In their proper
“ shell they assume different figures ; but, in
“ general, they somewhat resemble a muscle,
“ except that their shell is found actually com-
“ posed of five or more pieces, the smaller
“ valves serving to close up the openings left by
“ the irregular meeting of the two principal
“ shells. But their penetration into rocks, and
“ their residence there, makes up the most won-
“ derful part of their history.

“ This animal, when divested of its shell,
“ resembles a roundish, soft pudding, with no
“ instrument that seems in the least fitted for
“ boring into stones, or even penetrating the
“ softest substance. It is furnished with two
“ teeth indeed, but these are placed in such a
“ situation, as to be incapable of touching the
“ hollow surface of its stony dwelling : it has
“ also two covers to its shell, that open and shut
“ at either end ; but these are totally unservice-
“ able to it as a miner. The instrument with
“ which it performs all its operations, and bu-
“ ries itself in the hardest rocks, is only a broad
“ fleshy substance, which somewhat resembles
“ a tongue, issuing from the bottom of its shell.

“ With

“ With this soft, yielding instrument, it perforates the most solid marbles ; and having, while young, made its way by a very narrow entrance into the substance of the stone, as it grows larger it encreases the size of its apartment.”

The improbability of such animals being capable of penetrating into rocks, and even the hardest marbles, aided the supposition that they entered the stone while it was in a soft state, which hardening round them, by the petrifying quality of the water, they were enabled to form their habitations at pleasure. This opinion, though maintained by several of the ancient philosophers, has been successfully objected to by Dr. Bohads, who, in support of the contrary being the fact, observes, that “ many of the pillars of the Temple of Serapis, at Puetoli, were penetrated by the pholades ; and there can be no doubt of the animals having pierced into them since their erection, for no workmen would have laboured a pillar into form, if it had been honey-combed by worms in the quarry. In short, there can be no doubt but that the pillars were perfectly sound when erected, and that the pholades have attacked them during that time in which they conti-

“nued buried under water, by means of the
“earthquake which swallowed up the city.”

This animal, then, armed with nothing but a blunt augre of the softest texture, by perseverance and patience penetrates into one of the hardest of bodies. This operation it performs when very young and perfectly naked, and having made an entrance and buried its body in a stone, it there continues for life at his ease, the sea-water that enters at the little aperture supplying it with luxurious plenty. When the animal has taken too great a quantity of water, it spurns the superfluity out of its hole with some degree of violence. Upon this seemingly thin diet, it quickly grows larger, and soon finds a necessity for enlarging both habitation and shell. The motion of the pholas is slow beyond conception; its progress keeps pace with the growth of its body; and in proportion as it becomes larger, it makes its way farther into the rock. When advanced to a certain distance, it then changes its direction, and hollows downward, till at last, when its habitation is completed, the whole apartment resembles the bole of a tobacco-pipe; the hole in the shank being that by which the animal originally made its entry.

Thus

Thus immured, the pholas lives in darkness, indolence, and plenty; having once formed its mansion, it appears to live perfectly satisfied with the retreat it has chosen, nor ever after attempts its emancipation; the influx of the sea-water, that enters at the small original cavity, satisfies all its wants, and without any other food, they not only thrive, but frequently grow to seven or eight inches long, and are thick in proportion.

Besides the security, which they find in this stony habitation, their bodies are defended by a shelly covering, and which grows upon them after they have taken up their residence in the body of the rock. These shells take different forms, and are often composed of a different number of valves; sometimes six, and sometimes not more than three; sometimes the shell resembles a tube with holes at either end, one for the mouth, and the other for voiding the excrements.

“ Yet (says Goldsmith) the pholas thus shut
“ up, is not so solitary an animal as it would at
“ first appear; for though it is immured in its
“ hole without egress, though it is impossible
“ for the animal, grown to a great size, to get
“ out by the way it made in, yet many of this
“ kind

“ kind often meet in the heart of the rock, and,
“ like miners in a siege, who sometimes cross
“ each other’s galleries, they frequently break
“ in upon each other’s retreats. Whether their
“ thus meeting be the work of accident, or of
“ choice, few can take upon them to deter-
“ mine; certain it is, they are most commonly
“ found in numbers in the same rock; and
“ sometimes above twenty are discovered within
“ a few inches of each other.”

These animals are pretty generally diffused, but they are found in the greatest numbers at Ancona, in Italy; along the shores of Normandy and Poitou, in France; and upon some of the coasts of Scotland. They are generally held as a great delicacy, and in some places are sedulously sought after for the purpose of supplying the tables of the luxurious.





Frog



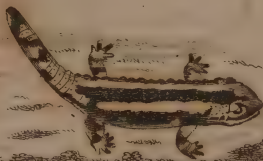
Boa Constrictor



Chameleon



Rattle Snake



Salamander

OF FROGS, LIZARDS, AND SERPENTS.

OF FROGS.

IT has already been observed, when treating generally of amphibious animals, in the Fourth Volume, that the whole of these animals, by their internal conformation, are equally capable of living upon land, or in the water, having their hearts so formed as to dispense with the assistance of the lungs in carrying on the circulation. The *frog* and the *toad* therefore can live several days under water without any danger of suffocation; they want but little air at the bottom, and what is wanting is supplied by lungs, like bladders, which are generally distended with wind, and answer all the purposes of a reservoir whence to breathe.

The frog and toad, though so nearly resembling each other, have many strong and striking differences,

differences, which particularly distinguish them from each other. The frog moves by leaping, the toad crawls along the ground. The frog is in general less than the toad; its colour is brighter, and with a more polished surface; the toad is brown, rough, and dusty. The frog is light and active, and its belly comparatively small; the toad is slow, swollen, and incapable of escaping. The frog, when taken, contracts itself so as to have a lump on its back: the toad's back is straight and even; and internally the lungs of the toad are found to be more compact than those of the frog, they have a less number of air-bladders, and, of course, the animal is less fitted for living under water.

The power which the frog possesses of leaping is remarkably great, compared to the size of its body. It is the best swimmer of all four-footed animals; and the formation of its parts are singularly adapted for that purpose, the arms being light and active, and the legs and thighs long, and furnished with very strong muscles. In dissecting this animal, it has been found, that its brain is very small in proportion to its size; that it has a very wide swallow; a stomach seemingly small, but capable of great distension. The heart in the frog, as in all other
animals

animals that are truly amphibious, has but one ventricle, so that the blood can circulate without the assistance of the lungs, while it keeps under water. The lungs resemble a number of small bladders joined together, like the cells of a honeycomb : they are connected to the back by muscles, and can be distended or exhausted at the animal's pleasure. The male has two testiculi lying near the kidneys ; and the female has two ovaries lying near the same place : but neither male nor female have any of the external instruments of generation, the anus serving for that purpose in both. Such are the most striking peculiarities in the anatomy of a frog ; and in these it agrees with the toad, the lizard, and the serpent. They are all internally formed in nearly the same manner, with spongy lungs, a simple heart, and are destitute of the external instruments that serve for continuing their kind.

Of all naturalists who have enquired into the nature and habits of the frog, Mr. Ræsel, of Nurembergh, is generally admitted to be the most particular and accurate. He says, “ the
 “ common brown frog begins to couple early
 “ in the season, and as soon as the ice is thawed
 “ from the stagnated waters. In some places
 VOL. V. D “ the

“ the cold protracts their genial appetite till
“ April, but it generally begins about the mid-
“ dle of March. The male is usually of a
“ greyish brown colour; the female is more
“ inclining to yellow, speckled with brown.
“ When they couple their colours are nearly
“ alike on the back, but as they change their
“ skins almost every eighth day, the old one
“ falling off in the form of mucus, the male
“ becomes more yellow, and the female more
“ brown. In the males the arms and legs are
“ much stronger than in the females; and at
“ the time of coupling they have, upon their
“ thumbs, a kind of fleshy excrescence; this
“ Linnæus supposed to be the male instrument
“ of generation, but, by closer inspection, it
“ is found only of service in holding the fe-
“ male in a more strict embrace; as it may be
“ cut off without impairing the impregnation,
“ and besides, it is sometimes found in the op-
“ posite sex.

“ The frogs only couple once a year, and
“ then continue united sometimes for four
“ days together. At this time they have both
“ their bellies greatly swollen; that of the fe-
“ male being filled with eggs, and the male
“ having the skin of its whole body distended
“ with

“ with a limpid water which is ejected in im-
“ pregnation. As soon as the male has leaped
“ upon the female, he throws his fore-legs
“ round her breast, and closes them so firmly
“ that it is impossible with the naked hands to
“ loose them. The male clasps his fingers be-
“ tween each other, and presses with the thick-
“ est sides of the thumbs against the breast of
“ the female; the grasp seems to be involun-
“ tary and convulsive: they cannot easily be
“ torn asunder; and they swim, creep, and live
“ united for some days successively, till the fe-
“ male has shed her spawn, or eggs. A single
“ female produces from six to eleven hundred
“ eggs at a time; and, in general, she throws
“ them all out together by a single effort, though
“ sometimes she is an hour in performing this
“ task; the eggs are impregnated by the insper-
“ sion of the male seminal fluid upon them as
“ they proceed from the body of the female.

“ When the spawn is emitted and impreg-
“ nated by the male, it sinks to the bottom of
“ the water; during the first four hours they
“ suffer no perceptible change, but when they
“ begin to enlarge, grow lighter, and, in
“ consequence, arise to the surface. At the
“ end of eight hours the white in which they

D 2

“ swim

“ swim grows thicker, the eggs, black at first,
“ begin to grow whiter, and as they encrease
“ in size take somewhat of a spherical form.
“ The twenty-first day the egg is seen to open
“ a little on one side, and the beginning of a
“ tail to peep out, which becomes more and
“ more distinct every day. The thirty-ninth
“ day the little animal begins to have motion;
“ it moves, at intervals, its tail, and it is per-
“ ceived that the liquor in which it is circum-
“ fused, serves it for nourishment. In two
“ days more some of these little creatures fall
“ to the bottom, while others remain swimming
“ in the fluid round them, and their vivacity
“ and motion is seen to encrease. Those which
“ fall to the bottom remain there the whole
“ day, but having lengthened themselves a lit-
“ tle, for hitherto they are doubled up, they
“ frequently mount to the mucus which they
“ had quitted, and feed upon it with great eager-
“ ness. The next day they acquire their tad-
“ pole form. In three days more they are per-
“ ceived to have two little fingers, that serve
“ as fins beneath the head; and these in four
“ days after assume a more perfect form. It is
“ then also they are seen to feed very greedily
“ on pond-weed, and on which they continue
“ to

“ to feed until they arrive at maturity. When
“ ninety-two days old, two small feet are seen
“ beginning to burgeon near the tail ; and the
“ head appears to be separate from the body.
“ In five days after this, they refuse all vegeta-
“ ble food ; their mouth appears furnished with
“ teeth ; and their hinder legs are completely
“ formed. In two days more, the arms are
“ perfectly produced ; when the frog is com-
“ pletely formed ; except that it still continues
“ to carry the tail, and at once resembles both
“ frog and lizard. In this state it continues
“ for about six or eight hours ; and then the
“ tail dropping off by degrees, the animal ap-
“ pears in its most perfect shape.

“ The frog having thus in less than a day
“ changed its figure, it changes its appetites
“ also. As soon as the animal acquires its
“ perfect state, from having fed upon vege-
“ tables, it becomes carnivorous, and lives en-
“ tirely upon worms and insects. But, as the
“ water cannot supply these, it is obliged to
“ quit its native element, and seek for food
“ upon land, where it lives by hunting worms
“ and taking insects by surprise. Being at all
“ times tenacious of the sun, they generally
“ continue in damp places shaded by reeds
“ and

“ and bushes; but after a shower of rain they
“ quit their retreats, and are sometimes seen in
“ great multitudes.

“ The frog lives for the most part out of
“ the water; but when the cold nights begin
“ to set in, it returns to its native element, al-
“ ways chusing stagnant waters, where it can
“ lie without danger concealed at the bottom.
“ In this manner it continues torpid, or with
“ but very little motion, all the winter, from
“ which it is roused by the approach of spring.
“ Like the rest of the dormant race, it requires
“ no food; and the circulation is slowly carried
“ on without any assistance from the air.

“ The difference of sexes, which was men-
“ tioned above, is not perceivable in these ani-
“ mals, until they have arrived at their fourth
“ year; nor do they begin to propagate till
“ they have compleated that period. By com-
“ paring their slow growth with their other
“ habitudes, it would appear, that they live
“ about twelve years; but having so many ene-
“ mies, both by land and water, it is probable
“ that few of them arrive at the end of their
“ term.”

These animals live upon all kinds of insects;
but they never eat any, unless they have mo-
tion.

tion. They continue fixed and immoveable till their prey appears; and just when it comes sufficiently near, they jump forward with great agility, dart out their tongues, and seize it with certainty. The tongue in this animal, as in the toad, lizard, and serpent, is extremely long, and formed in such a manner, that it swallows the point down its throat; so that a length of tongue is thus drawn out, like a sword from its scabbard, to assail its prey. This tongue is furnished with a glutinous substance; and whatever insect it touches, it infallibly adheres to it, which is thus held fast till it is drawn into the mouth.

A very little food, however, seems to satisfy their wants, and they are capable of bearing hunger for a considerable time. A German surgeon states, that he kept one eight years in a glass vessel covered with a net; that its food at all times was but sparing; in summer he gave it fresh grass, and in winter, hay a little moistened; he frequently put flies into the glass, which it would follow, and was very expert at catching. In winter, when the flies are difficult to be procured, it usually fell away, but in summer, on being supplied with plenty of them, it soon grew fat again. He constantly kept it in a warm room, and it was
always

always lively, and ready to take its prey; however, in the eighth winter, there being no flies to be found, it sickened and died.

These animals are very tenacious of life; they will live and jump about for several hours after their heads are severed from their bodies; nay, they will continue active, though all their bowels be taken out, and live for some days, even after being entirely stripped of their skins.

The croaking of frogs is well known; whence in some countries, they are distinguished by the ludicrous title of Dutch Nightingales. The large water, or *bull frogs*, of the northern countries, have a note as loud as the bellowing of a bull; and, for this purpose, puff up the cheeks to a surprising magnitude. Of all frogs, however, the male only croaks; the female is silent. At the time of coupling, and before wet weather, their voices are in full exertion; they are then heard with unceasing assiduity, sending forth their call, and welcoming the approaches of their favourite moisture. No weather-glass was ever so true as a frog in foretelling an approaching change. This may probably serve to explain an opinion which some entertain, that there is a month in the

the

the year, called Paddock Moon, in which the frogs never croak: the whole seems to be no more than that, in the hot season, when the moisture is dried away, and consequently when these animals neither enjoy the quantity of health nor food that at other times they are supplied with, they shew, by their silence, how much they are displeased with the weather.

As frogs adhere closely to the back of their own species, so it has been found, by repeated experience, that they will also adhere to the backs of fish. Every one that has ponds knows that these animals will stick to the backs of carp, and fix their fingers in the corner of each eye. In this manner they are often caught together; the carp blinded and wasted away. Whether this proceeds from the desire of the frog, disappointed of its proper mate, or whether it proceeds from natural enmity to fish is a matter of doubt, though the following story related by Walton, seems to confirm the latter opinion: “As Dubravius, a bishop of Bohemia, was walking with a friend by a large pond in that country, they saw a frog, when a pike lay very sleepily and quiet by the shore side, leap upon his head; and the frog having expressed malice or anger by his swollen
VOL. V. E “ cheeks

“ cheeks and staring eyes, did stretch out his
“ legs, and embraced the pike’s head, and pre-
“ sently reached them to his eyes, tearing with
“ them and his teeth those tender parts; the
“ pike, irritated with anguish, moves up and
“ down the water, and rubs himself against
“ weeds, and whatever he thought might quit
“ him of his enemy; but all in vain, for the
“ frog did continue to ride triumphantly, and
“ to bite and torment the pike till his strength
“ failed, and then the frog sunk with the
“ pike to the bottom of the water; then pre-
“ sently the frog appeared again at the top, and
“ croaked, and seemed to rejoice like a con-
“ queror, after which, he presently retired to
“ his secret hole. The bishop that had beheld
“ the battle, called the fisherman to fetch his
“ nets, and by all means to get the pike, that
“ they might declare what had happened. The
“ pike was drawn forth, and both his eyes eaten
“ out; at which, when they began to wonder,
“ the fisherman wished them to forbear, and
“ assured them, that he was certain pikes were
“ often so served.”

The *Toad*. If we regard the figure of the
toad, there seems nothing in it that should dis-
gust, more than that of the frog. Its form and
proportions

proportions are nearly the same; and its chief difference is in its colour, which is blacker; and its slow and heavy motion, which exhibits nothing of the agility of the frog: yet such is the force of habit, begun in early prejudice, that those who consider the one as a harmless, playful animal, turn from the other with horror and disgust. The frog is considered as a useful assistant in ridding our grounds of vermin; the toad, as a secret enemy, who only wants an opportunity to infect us with its venom.

As the toad bears a general resemblance in figure to the frog, so also it resembles that animal in its nature and appetites. It has been said by a French gentleman, that he saw an instance, in the king's gardens at Paris, of the male toad assisting the female in the exclusion of her eggs, but naturalists agree, that it must have been an uncommon circumstance, possibly arising from the delivery being on land, as it is invariably the same as with the frogs when in the water. When like the frog, these animals have undergone all the variations of their tadpole state, they forsake the water, and are often seen, in a moist summer's evening, crawling up, by myriads, from fenny places, into drier situations. There, having found out a

retreat, or having dug themselves one with their mouth and hands, they lead a solitary life, seldom venturing out, except when the moisture of a summer's evening invites them abroad. At that time the grass is filled with snails, and the pathway covered with worms, which constitute their principal food. Insects also, of every kind, they are fond of; and Linnæus asserts, that they sometimes continue immoveable, with the mouth open, at the bottom of shrubs, where the butterflies, in some measure fascinated, are seen to fly down their throats.

In a letter from Mr. Arscott, there are some curious particulars relating to this animal, which throw great light upon its history. "Concerning the toad," says he, "that lived so many years with us, and was so great a favourite, the greatest curiosity was its becoming so remarkably tame: it had frequented some steps before our hall door some years before my acquaintance commenced with it, and had been admired by my father for its size (being the largest I ever met with) who constantly paid it a visit every evening. I knew it myself above thirty years; and by constantly feeding it, brought it to be so tame, that it always

" came

“ came to the candle, and looked up, as if ex-
“ pecting to be taken up and brought upon the
“ table, where I always fed it with insects of all
“ sorts. It was fondest of flesh maggots, which
“ I kept in bran; it would follow them, and
“ when within a proper distance, would fix his
“ eyes, and remain motionless, for near a
“ quarter of a minute, as if preparing for the
“ stroke, which was an instantaneous throwing
“ of its tongue at a great distance upon the in-
“ sect, which stuck to the tip by a glutinous
“ matter. The motion is quicker than the
“ eye can follow. I cannot say how long my
“ father had been acquainted with the toad,
“ before I knew it; but when I was first ac-
“ quainted with it, he used to mention it as the
“ old toad I have known so many years. I can
“ answer for thirty-six years. The old toad
“ made its appearance as soon as the warm wea-
“ ther came; and I always concluded it retired
“ to some dry bank, to repose till spring. When
“ we new laid the steps, I had two holes made
“ in the third step, on each side, with a hollow
“ of more than a yard long for it; in which I
“ imagine it slept, as it came thence at its first
“ appearance. It was seldom provoked. Nei-
“ ther that toad, nor the multitudes I have seen
“ tormented

“ tormented with great cruelty, ever shewed
“ the least desire of revenge, by spitting or
“ emitting any juice from their pimples. Some-
“ times, upon taking it up, it would let out a
“ great quantity of clear water, which, as I
“ have often seen it do the same upon the steps
“ when quite quiet, was certainly its urine, and
“ no more than a natural evacuation. Spiders,
“ millepedes, and flesh maggots, seem to be
“ this animal’s favourite food. I imagine if a
“ bee was to be put before a toad, it would cer-
“ tainly eat it to its cost; but as bees are seldom
“ stirring at the same time that toads are, they
“ rarely come in their way; as they do not ap-
“ pear after sun-rising, or before sun-set. In
“ the heat of the day they will come to the
“ mouth of their hole, I believe for air. I
“ once, from my parlour-window, observed a
“ large toad I had in the bank of a bowling-
“ green, about twelve at noon, a very hot day,
“ very busy and active upon the grass. So un-
“ common an appearance made me go out to
“ see what it was; when I found an innumera-
“ ble swarm of winged ants had dropped round
“ his hole; which temptation was as irresisti-
“ ble as a turtle would be to a luxurious alder-
“ man. In respect to its end, had it not been
“ for

“ for a tame raven, I make no doubt but it
“ would have been now living. This bird, one
“ day, seeing it at the mouth of its hole, pulled
“ it out, and, although I rescued it, pulled out
“ one eye, and hurt it so, that, notwithstanding
“ its living a twelvemonth, it never enjoyed
“ itself, and had a difficulty of taking its food,
“ missing the mark for want of its eye. Be-
“ fore that accident, it had all the appearance
“ of perfect health.”

Valisnieri also mentions a circumstance to
prove that toads, if even taken internally, are
no ways dangerous. This author says, “ in the
“ year 1692, some German soldiers, who had
“ taken possession of the castle of Arceti, find-
“ ing that the peasants of the country often
“ amused themselves with catching frogs,
“ and dressing them for the table, resolved to
“ provide themselves with the like entertain-
“ ment, and made preparations for frog-fishing
“ in the same manner. It may easily be sup-
“ posed that the Italians and their German
“ guests were not very fond of each other; and
“ indeed it is natural to think that the soldiers
“ gave the poor people of the country many
“ good reasons for discontent; they were not a
“ little pleased, therefore, when they saw them
“ go

“ go to a ditch where toads, instead of frogs,
“ were found in abundance. The Germans
“ no way distinguishing their sport, caught
“ them in great numbers ; while the peasants
“ kept looking on, silently flattering themselves
“ with the hopes of speedy revenge. After be-
“ ing brought home, the toads were dressed up,
“ after the Italian fashion : the peasants quite
“ happy at seeing their tyrants devour them
“ with so good an appetite, and expecting every
“ moment to see them drop down dead. But
“ what was their surprise to find, that the Ger-
“ mans continued as well as ever, and only
“ complained of a slight excoriation of the
“ lips, which probably arose from some other
“ cause than that of their repast.”

Solenander also relates a story which serves
to exculpate toads from the charge of pos-
sessing any poisonous qualities : “ A tradesman
“ of Rome,” says he, “ and his wife had long
“ lived together with mutual discontent ; the
“ man was dropsical, and the woman amorous :
“ this ill-matched society promised soon, by the
“ very infirm state of the man, to have an end ;
“ but the woman was unwilling to wait the
“ progress of the disorder, and therefore con-
“ cluded, that to get rid of her husband, no-
“ thing

“ thing was left her but poison. For this pur-
“ pose she chose out a dose that she supposed
“ would be most effectual, and having calcined
“ some toads, mixed their powder with his
“ drink. The man, after taking a hearty dose,
“ found no considerable inconvenience, except
“ that it greatly promoted urine. His wife,
“ who considered this as a beginning symptom
“ of the venom, resolved not to stint the next
“ dose, but gave it in greater quantities than
“ before. This also encreased the former symp-
“ tom; and, in a few days, the woman had the
“ mortification to see her detested husband re-
“ stored to perfect health, and remained in ut-
“ ter despair of ever being a widow.”

Here then we have sufficient evidence of the injustice with which this animal has been treated. It has been held forth as possessing a poison with which it could kill at a distance; of ejecting its venom upon whatever gave it disturbance; of infecting those vegetables near which it resides; of having an excessive fondness for sage, and poisoning every plant upon which it had fed; with a thousand other charges equally false and absurd, and which have most probably been attributed to it by those who have taken an antipathy to the animal from its forbidding and unpleasing appearance; and as

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early prejudices are not easily surmounted, it is difficult to consider the toad in any other view than a venomous creature; while the fact as stated by an ingenious writer is, that “The toad is a harmless, defenceless creature, torpid and unvenomous, and seeking the darkest retreats, not from the malignity of its nature, but the multitude of its enemies*.”

Like all the frog kind, the toad is torpid in winter. It then chuses for a retreat either the hollow root of a tree, the cleft of a rock, or sometimes the bottom of a pond, where it is found in a state of seeming insensibility. As it is very long-lived, it is extremely difficult to kill; its skin is tough, and cannot be easily pierced; and, though covered with wounds, the creature continues to shew signs of life, and every part appears in motion. But what shall we say to its living for centuries lodged in the bosom of a rock, or cased within the body of an oak tree, without the smallest access on any side,
either

* Poetry too has lent its aid to countenance this idea of the toad being a venomous animal: and it is usually coupled with sentiments of abhorrence and malignity. Thus Shakespeare in *Lear* exclaims,

“From the extremest upward of thy head,
To the descent and dust below thy foot,
A most toad spotted traitor.”

Bacon says, that in the great plague, there were seen in divers ditches about London, many toads that had tails three inches long, whereas toads usually have no tails.

either for nourishment or air, and yet taken out alive and perfect? Stories of this kind it would be as rash to contradict as difficult to believe; we have the highest authorities being witness to their truth, and yet the whole analogy of nature seems to arraign them to falsehood. Bacon asserts, that toads are found in this manner; Dr. Plot asserts the same; there is to this day, a marble chimney-piece at Chatsworth with the print of the toad upon it, and a tradition of the manner in which it was found. In the Memoirs of the Academy of Sciences, in the year 1719, there is an account of a toad that was found alive and healthy in the heart of a very thick elm, without the smallest entrance or egress. In the year 1731, there was another found near Nantes in the heart of old oak, without the smallest issue to its cell; and the discoverer was of opinion, from the size of the tree, that the animal could not have been confined there less than eighty or a hundred years, without sustenance, and without air. In contradiction to these accounts there is the necessity which the animal appears under of receiving air: and its dying, like other animals, if put into an air-pump, and deprived of that all-sustaining fluid *.

F 2 A no

* Mr. Barrow in his Travels in China, mentions the following circumstance, "A remarkable circumstance not easily
to

A no less doubtful property has been given to toads; namely, that of sucking out the poison from cancerous breasts, and thus performing a cure; a circumstantial detail of their performing which is given in a letter by Dr. Pitfield to the bishop of Carlisle. He says, the toads were put into a linen cloth, all but their heads, which being placed near the affected part, they immediately laid hold, and sucked with great greediness until they were very much swollen, when they fell off and expired; and he was convinced of their having sucked, by weighing them before and after they were applied to the breast. Their sucking, however, has been positively denied by others, who indeed admit of their swelling and dying, but that they think it as likely to be occasioned by the external as the internal application of the cancerous poison.

Of

to be accounted for, occurred in opening a cask of Birmingham hardware. Every one knows the necessity of excluding the sea air as much as possible from highly polished articles of iron and steel, and accordingly all such articles intended to be sent abroad are packed with the greatest care. The casks or cases are made as light as possible and covered with pitched canvass. Yet, when the head was taken off, and a few of the packages removed, an enormous large scorpion was found in the midst of the cask, nearly in a torpid state, but it quickly recovered on exposure to the warm air.

"This thing we know is neither rich nor rare,

"But wonder how the devil it got there."

See *Barrow's Travels*, and *Universal Magazine*, VOL. II. New Series (1804) p. 441.

Of this animal there are several varieties; such as the water and the land toad, which probably differ only in the ground-colour of their skin. In the first, it inclines to ash colour, with brown spots; in the other, the colour is brown, approaching to black. The water-toad is not so large as the other; but both equally breed in that element. The size of the toad with us is generally from two to four inches long; but in the fenny countries of Europe, they are seen much larger, and not less than a common crab. But this is nothing to what they are found in some of the tropical climates, where travellers often, for the first time, mistake a toad for a tortoise. Their usual size is from six to seven inches; but there are some still larger, and as broad as a plate. Of these, some are beautifully streaked and coloured; some studded over, as with pearls; others bristled with horns or spines; some have the head distinct from the body, while others have it so sunk in, that the animal appears without a head. With us, the opinion of its raining toads and frogs, has long been justly exploded; but it still is entertained in the tropical countries, and that not only by the savage natives, but the more refined settlers, who are weak enough to add the prejudices of other nations to their own.

The *Pipal*, or the *Surinam Toad*, is in form more hideous than even the common toad. According to Seba, the body is flat and broad; the head small; the jaws, like those of a mole, are extended and evidently formed for rooting in the ground; the skin of the neck forms a sort of wrinkled collar: the colour of the head is of a dark chesnut, and the eyes are small: the back, which is very broad, is of a lightish grey, and seems covered over with a number of small eyes, which are round, and placed at nearly equal distances. These eyes are very different from what they seem; they are the animal's eggs covered with their shells, and placed there for hatching. These eggs are buried deep in the skin, and in the beginning of gestation but just appear; they are very visible however when the young animal is about to burst from its confinement. They are of a reddish shining yellow colour; and the spaces between them are full of small warts, resembling pears. The eggs, when formed in the ovary, are sent by some internal canals, to lie and come to maturity under the bony substance of the back. In this state they are impregnated by the male, whose seed finds its way by pores very singularly contrived, and pierces not only the skin, but the periosteum. The skin, however, is still
apparently

apparently entire, and forms a very thick covering over the whole brood, but as they advance to maturity, at different intervals, one after another, the egg seems to start forward from the back, becomes more yellow, and at last breaks, when the young one puts forth its head; it still, however, keeps its situation, until it has acquired a proper degree of strength, and then it leaves the shell, but does not immediately quit the back of the parent.

In this manner the pipal is seen travelling, with her numerous family on her back, in all the different stages of maturity. Some of the strange progeny, not yet come to sufficient perfection, appear quite torpid, and as yet without life in the egg: others seem just beginning to rise through the skin; here peeping forth from the shell, and there, having entirely forsaken their prison: some are sporting at large upon the parent's back; and others descending to the ground, to try their own fortune below.

The male pipal is much larger than the female, and has the skin less tightly drawn round the body, the whole of which is covered with pustules resembling pearls; the belly, which is of a bright yellow, seems as if it were sewed up from the throat to the vent, a seam apparently running in that direction. This animal, like the rest of the frog kind, is most probably harmless,

harmless, though we are told of most terrible effects resulting from its powder when calcined, the absurdity of which is evident, all animal substances being the same when they have passed the fire.

THE LIZARD.

IT is difficult to ascertain to what class in nature lizards are chiefly allied. They are unjustly raised to the rank of beasts, as they bring forth eggs, dispense with breathing, and are not covered with hair. They cannot be placed among fish, as the majority of them live upon land: they are excluded from the serpent tribe, by their feet, upon which they run with some celerity; and from the insects, by their size; for though the newt may be looked upon in this contemptible light, a camelion would be a terrible insect indeed.

As lizards thus differ from every other class of animals, they also differ widely from each other. With respect to size, no class of beings has its ranks so opposite.

The colour of these animals is also very various, as they are found of a hundred different hues, green, blue, red, chesnut, yellow, spotted,

spotted, streaked, and marbled. Were colour alone capable of constituting beauty, the lizard would often please; but there is something so repulsive in the animal's figure, that the brilliancy of its scales, or the variety of its spots, only tend to give an air of more exquisite venom, of greater malignity. The figure of these animals is not less various; sometimes swollen in the belly; sometimes pursed up at the throat; sometimes with a rough set of spines on the back, like the teeth of a saw; sometimes with teeth, at others with none; sometimes venomous, at others, harmless, and even philanthropic: sometimes smooth and even: sometimes with a long, slender tail; and often with a short blunt one.

But their greatest distinction arises from their manner of bringing forth their young: some of them, particularly the large animals, (among whom is generally ranked the crocodile, already treated of in the fourth volume) are produced perfectly from the egg; some, as most of the *salamander* tribe, are viviparous; and many of the water-lizards are brought forth from spawn, like fish. The whole of them have, nevertheless, many points of similitude,

and in all their varieties of figure, colour, and production, this tribe is easily distinguished, and strongly marked. They have all four short legs; the two foremost somewhat resembling a man's hand and arm; they have tails almost as thick as the body at the beginning, and which commonly run tapering to a point; they are all amphibious, equally capable of living upon land and water. These peculiarities sufficiently separate lizards from all other animals; but no one has hitherto been able to point out the limits which separate the three kinds from each other.

The *iguana*, or *guana*, is a native of the Bahama islands, and is next to the crocodile, in size, being frequently found to measure five feet in length. It commonly inhabits the rocks in the Bahama islands, though sometimes met with in hollow trees. It feeds entirely on fruits and vegetables, and the fat of the abdomen assumes the colour of that which it has last eaten. It is slow of motion, and has a most disgusting look. Besides the usual characteristics of the kind, the top of the back and great part of the tail are strongly serrated; notwithstanding which it is a delicate and wholesome food, and held in
much

must estimation. It is said that this species is not amphibious, yet on necessity will continue long under water; it swims by means of the tail, keeping its legs close to the body. They form great part of the support of the inhabitants of the Bahama islands, who go from rock to rock in search of them. They are taken with dogs trained for the purpose; and as soon as caught, their mouths are sewed up to prevent them from biting; for they have a quantity of small sharp teeth, and bite very hard. Some are carried alive for sale to Carolina; and others are salted and barrelled for home consumption.

The Common *green lizard* is a native of both Europe and India; this species is extremely nimble; it basks on the sides of dry banks, or under old trees in hot weather, but on being observed, immediately retreats to its hole. The food of this, as well as of all other British lizards, is insects, and they themselves are devoured by birds of prey. They are all perfectly harmless; yet their form strikes almost every beholder with disgust, and has occasioned great obscurity in their history. Mr. Pennant mentions a lizard killed in Worcestershire in the year 1714, which was two feet

six inches long, and four inches in girth: the fore-legs were placed eight inches from the head, the hind-legs five inches behind those; the legs were two inches long; the feet divided into four toes, each furnished with a sharp claw. Another of the same kind was afterwards killed in that county: but whether these large lizards were natives of other countries, and imported into England, or whether they were of British growth, is uncertain; though the former is most probable, as in this country they scarcely ever exceed six inches. This species have a pretty long verticillated tail, with sharp scales, and a scaly collar.

The *green lizard*, of Carolina, is so denominated from its colour: it is very slender; the tail is nearly double the length of the body, and the whole length above five inches. It inhabits Carolina, where it is domestic, familiar, and harmless. It sports on the tables and windows, and amuses with its agility in catching flies. Cold affects its colours; in that uncertain climate, where there is a quick transition in the same day from hot to cold, it changes instantly from the most brilliant green to a dull brown. They are a prey to cats and ravenous birds. They appear chiefly in summer, and at
the

the approach of cold weather, they retire to their winter recesses, and lie torpid in the holes and crevices of hollow trees. It frequently happens, that a few warm sunshiny days so invigorate them, that they will come out of their holes, and appear abroad; when on a sudden the weather changing to cold, so enfeebles them, that they are unable to return to their retreats, and will die of cold.

The *cameleon* has a crooken cylindrical tail; the head of a large one is almost two inches long, and from thence to the beginning of the tail, it is four inches and a half; the tail is five inches long, and the feet two and a half: the thickness of the body is different at different seasons; sometimes, from the back to the belly, it is two inches, and sometimes but one, for he can expand, and contract himself at pleasure; this swelling and contraction is not only of the back and belly, but also of the legs and tail.

These different motions are not like those of other animals, which proceed from a dilatation of the breast in breathing, and which rises and falls successively; but they are very irregular, as in tortoises and frogs. The *cameleon* has continued, as it were blown up for two hours together,

together, and then he would grow less and less insensibly, for the dilatation was always more quick and visible than the contraction; in this last state he appeared extremely lean, and the spine of the back was sharp, and all his ribs might be told; the skin is very cold to the touch; and notwithstanding he seems so lean, the beating of the heart is not perceptible; the surface of the skin is unequal, and has a grain not unlike shagreen, but very soft, because each eminence is as smooth as if it were polished. Some of these are as large as a middling pin's head on the arms, legs, belly, and tail; but on the shoulders and head they are of an oval figure, and a little larger; those under the throat are ranged in the form of a chaplet, from the lower lip to the breast: some on the head and back are amassed together in clusters, with spaces between them, in which are almost imperceptible spots of a pale red and yellow colour, as well as the ground of the skin itself, which plainly appears between these clusters. This ground changes colour when the animal is dead, becoming of a greyish brown, and the small spots are whitish.

The colour of all these eminences, when the cameleon is at rest in a shady place, is of a bluish grey, except on the claws, where it is white,

white, with a little yellow, as was before observed; but when he is in the sun, all parts of the body which are affected with the light, become of a greyish brown, or rather of a tawney. That part of the skin which the sun does not shine on, changes into several brighter colours, which form spots of the size of half one's finger. Some of these descend from the spine half way on the back; and others appear on the sides, arms and tail. They are all of an Isabella colour, from a mixture of a pale yellow and a bright red, which is the colour of the ground of the skin.

The head of a cameleon is not unlike that of a fish, it being joined to the breast by the very short neck, covered on each side with cartilaginous membranes resembling the gills of fish. There is a crest directly on the top of the head, and two others on each side above the eyes, and between these there are two cavities near the top of the head; the muzzle is blunt, and not much unlike that of a frog; at the end there is a hole on each side for the nostrils, but there are no ears, nor any sign of any.

The jaws are furnished with teeth, or rather with a bone in the form of them, which he makes little or no use of, because he lives upon swallowing

lowing flies, and other insects, without chewing them; and hence arose the vulgar notion of his living upon air, because he was never seen to eat. The tongue, which Linnæus says resembles an earth-worm, is of considerable length, and is enlarged and somewhat flattened at the end. From this membrane there continually oozes out a very glutinous liquor, by means of which it catches such insects as come within its reach, and it is surprising to see with what quickness it retracts its tongue the instant it has arrested any prey; the form, structure, and motion of the eyes, have something very particular; for they are very large, being almost half an inch in diameter. They are of a globous figure, which may be easily seen, because they stand out of the head; they have a single eye-lid like a cap, with a small hole in the middle, through which the sight of the eye appears no bigger than a pin's head, and of a shining brown, encircled by a little ring of a gold colour.

This eye-lid has a grain like shagreen as well as the other parts of the skin; and when the rest of the body changes colour, and assumes spots of different shapes; those on the lid always keep the same form, though they are tinted

tured with the same colour as the skin. But the most extraordinary thing relating to the eyes is, that this animal often moves one when the other is entirely at rest; nay, sometimes one eye will seem to look directly forward, and the other backward, and one will look up to the sky, while the other regards the earth.

That part of the body which is called the trunk, and comprehends the thorax and the belly in a cameleon, is almost all thorax, with little or no belly; the four feet are all of a length; and the only difference between them is, that those before are turned backwards, and those behind forwards. There are five toes on each paw, which have a greater resemblance to hands than feet; they are all divided into two, which gives the appearance of two hands to each arm, and two feet to each leg; and though one of these parts has three toes, and the other but two, yet they seem to be all of the same size. These toes lie together under the same skin, as in a kitten; however, their shape might be seen through the skin. With these paws the cameleon can lay hold of the small branches of trees in the same manner as a parrot. When he is about to perch, he parts his toes differently from birds, because he puts two behind and two before. The claws are little, crooked,

very sharp, and of a pale yellow, proceeding but half way out of the skin, while the other half is hid beneath it; his walk is slower than that of a tortoise, and he seems to move along with an affectation of gravity; he seems to seek for a proper place to set his feet upon; and when he climbs up trees, he does not trust to his feet like squirrels, but endeavours to find out clefts in the bark, that he may get a surer hold.

His tail is like that of a viper when it is puffed and round; for otherwise the bones may be seen in the same manner as on the back; he always wraps his tail round the branches of trees, and it serves him instead of a fifth hand. He is a native of Africa and Asia*.

The *Gecko* has a cylindrical tail, concave ears, and a warty body; it is the *Indian Salamander* of Bontius. "This animal is very frequent in Cairo, says Hasselquist, both within the houses, and without them. The poison of this animal is very singular, as it exhales from the lobuli of the toes. The animal seeks all places and things impregnated with sea-

* The most interesting and complete account of the camelion, its Manners, Habits, and mode of Subsistence, &c. is to be found in *Golberry's travels in Africa*, p. I. et seq. of the second volume.

He has there carefully examined them, and communicated his results.

“ sea-salt, and passing over them several times,
 “ leaves this very noxious poison behind it. In
 “ July, 1730, I saw two women and a girl at
 “ Cairo, at the point of death, from eating
 “ cheese newly salted, bought in the market,
 “ and on which this animal had dropt its poison.
 “ Once at Cairo, I had an opportunity of ob-
 “ serving how acrid the exhalations of the toes
 “ of this animal are, as it ran over the hand of
 “ a man who endeavoured to catch it; there
 “ immediately arose little pustules over all those
 “ parts the animal had touched; these were
 “ red, inflamed, and smarted a little, greatly
 “ resembling those occasioned by the stinging
 “ of nettles. It emits an odd sound, especially
 “ in the night, from its throat, not unlike that
 “ of a frog.”

The *Sincus* has a cylindrical tail, compressed
 at the point, and blunt margined toes. This
 animal is found in Arabia Petræa, near the Red
 Sea, and in Upper Egypt, near the Nile; it is
 much used by the inhabitants of the East as an
 aphrodisiac, but not at this time by the Euro-
 peans. The flesh of the animal is given in
 powder, with some stimulating vehicle; broth,
 made of the recent flesh, is likewise used by the
 Arabs. It is brought from Upper Egypt and
 Arabia to Alexandria, whence it is carried to

Venice and Marseilles, and from thence to all the apothecaries shops of Europe.

The *Nilotica* has a long tail, with a triangular edge, and four lines of scales on the back; it is met with in the moist places of Egypt, near the Nile. The Egyptians say that this lizard proceeds from the eggs of the crocodile laid in the sand; while the crocodile proceeds from those laid in the water. Mr. Hasselquist has detected the fallacy of this account.

The *Palustris* has a lanceolated tail, and four toes on the fore-feet, and inhabits the stagnant waters of Europe; it has a slow and crawling pace. Mr. Pennant mentions his having more than once found under stones and old logs some very minute lizards that had much the appearance of this kind; they were perfectly formed, and had not the least vestiges of fins, which circumstance, joined to their being found in a dry place remote from water, seems to indicate that they had never been inhabitants of that element; as it is certain many of our lizards are in their first state. At that period they have a fin above and below their tail; that on the upper part extends along the back as far as the tail, but both drop off as soon as the animal takes to the land, being then no longer

longer of any use. Mr. Ellis has remarked certain pennated fins at the gills of one species, which is very common in most of our stagnating waters, and is frequently observed to take bait like a fish.

The *salamander* has a short cylindrical tail, four toes on the fore-feet, and a naked porous body. The ancients, for what reason it would be difficult to say, attributed to this animal the property of being able to live in fire; but what is more extraordinary, the same circumstance is seriously detailed as a fact in the Philosophical Transactions. This species is found in most of the southern countries of Europe; and of which the Comte de la Cépède has given the most accurate account. Whilst the hardest bodies, says he, cannot resist the violence of fire, the world have endeavoured to make us believe that a small lizard can not only withstand the flames, but even extinguish them.

As agreeable fables readily gain belief, every one has been eager to adopt that of a small animal so highly privileged, so superior to the most powerful agent in nature, and which could furnish so many objects of comparison to poetry, so many pretty emblems to love, and so many brilliant devices to valour. The ancients believed this property of the salamander, wishing

that its origin might be as surprising as its power, and being desirous of realizing the ingenious fictions of the poets, they have pretended that it owes its existence to the purest of elements, which cannot consume it; and they have called it the daughter of fire, giving it, however, a body of ice. The moderns have followed the ridiculous tales of the ancients; and as it is difficult to stop when once the bounds of probability are passed, some have gone so far as to think that the most violent fire could be extinguished by the land salamander. Quacks sold this small lizard, affirming, that if thrown into the greatest conflagration it would check its progress. It was very necessary that philosophers and naturalists should take the trouble to prove by facts what reason alone might have demonstrated; and it was not till after the light of science was diffused abroad, that the world gave over believing in this wonderful property of the salamander. This lizard, which is found in so many countries in the ancient world, and even in very high latitudes, has been, however, but very little noticed, because it is seldom seen out of its hole, and because it for a long time inspired so much terror: even Aristotle speaks of it as an animal with which he was not much acquainted.

One of the largest of this species, which was preserved in the French king's cabinet, was seven inches five lines in length, from the end of the muzzle to the root of the tail, which is three inches eight lines. The skin does not appear to be covered with scales, but it is furnished with a number of excrescences like teats, containing a great many holes, several of which may be very plainly distinguished by the naked eye, and through which a kind of milk oozes, that generally spreads itself in such a manner as to form a transparent coat of varnish above the skin of this oviparous quadruped, which is naturally dry.

The eyes of the salamander are placed in the upper part of the head, which is a little flattened; their orbit projects into the interior part of the palate, and is there almost surrounded by a row of very small teeth, like those in the jaw-bones; these teeth establish a near relation between lizards and fish, many species of which have also several teeth placed in the bottom of the mouth. The colour of this lizard is very dark; upon the belly it has a blueish cast, intermixed with somewhat large irregular yellow spots, that extend over the whole body, and even to the feet and eye-lids; some of these spots are besprinkled
with

with small black specks, and those which are upon the back often coalesce without interruption and form two long yellow bands. The colour, however, must be subject to vary, as it appears that some salamanders are found in the marshy forests of Germany, which are quite black above and yellow below. To this variety we must refer the black salamander found by Mr. Laurenti in the Alps, which he considered as a distinct species.

The salamander, like frogs, has no ribs, and it has a great resemblance to the latter in the general form of the anterior part of its body. When touched, it suddenly covers itself with that kind of coat of which we have spoken, and it can also very rapidly change its skin from a state of humidity to a state of dryness. The milk which issues from the small holes in its surface is very acrid; when put upon the tongue it produces a sensation as if a kind of scar were left on the part which it touched. This milk, which is considered as an excellent substance for taking off hair, has some resemblance to that which distils from those plants called *esula* and *euphorbium*. When the salamander is crushed, or when it is only pressed, it exhales a bad smell, which is peculiar to it.

Salamanders

Salamanders are fond of cold damp places, thick shades, tufted woods, or high mountains, and the banks of streams that run through meadows: they sometimes retire in great numbers to hollow trees, hedges, and below old rotten stumps. They pass the winter in places of high latitude, in a kind of burrows, where they are found collected, several of them being joined and twisted together. The salamander being destitute of claws, having only four toes on each of the fore-feet, and no advantage of conformation making up the deficiencies, its manner of living must, as indeed is the case, be very different from that of other lizards. It walks very slowly; far from being able to climb trees with rapidity, it often appears to drag itself with great difficulty along the surface of the earth. It seldom goes far from the place of shelter it has fixed on; it passes its life under the earth, often at the bottom of old walls during summer; it dreads the heat of the sun, which would dry it, and it is commonly only when rain is about to fall that it comes forth from its secret asylum, as if by a kind of necessity, to bathe itself, and to imbibe an element to which it is analogous. Perhaps it finds then with greatest facility those insects upon which it feeds. It lives upon flies,

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beetles, snails, and earth-worms; when it reposes, it rolls up its body in several folds like serpents. It can remain some time in the water without danger, and it casts a very thin pellicle of a greenish grey colour. Salamanders have even been kept more than six months in the water of a well without giving them any food; care only was taken to change the water often.

It has been remarked, that every time a salamander is plunged into the water, it attempts to raise its nostrils above the surface as if to seek for air, which is an additional proof that all oviparous quadrupeds have a need of respiration during the time they are not in a state of torpor. The salamander has apparently no ears, and in this it resembles serpents. It has even been pretended that it does not hear, and in consequence it has got the name of *sourd* in some provinces of France. This is very probable, as it has never been heard to utter a cry, and silence in general is coupled with deafness. Having then, perhaps, one sense less than other animals, and being destitute of the faculty of communicating its sensations to those of the same species, it must be reduced to an inferior degree of instinct; it is therefore very stupid, and not bold, as some have

have asserted ; it does not brave danger, as has been pretended, and probably because it does not perceive it. Whatever gestures are made to frighten this animal, it always advances without turning aside ; however, as no animal is deprived of that sentiment necessary for its preservation, it suddenly compresses its skin when tormented, and spurts forth, upon those who attack it, that corrosive milk which is under the skin. If beaten it begins to raise its tail ; afterwards it becomes motionless, as if stunned by a kind of paralytic stroke ; for we must not, with some naturalists, ascribe to an animal so devoid of instinct, so much art and cunning as to counterfeit death. In short, it is very difficult to kill the salamander ; but when dipped in vinegar, or surrounded with salt reduced to a powder, it expires in convulsions, as is the case with several other lizards and worms.

It seems that we cannot allow a being a chimerical quality, without refusing it at the same time, a real property. The cold salamander has been considered as an animal endued with the miraculous power of resisting, and even of extinguishing fire ; but it has also been debased as much as elevated by this singular property. It has been made the most fatal of animals : the

ancients, and even Pliny, have devoted it to a kind of anathema, by affirming that its poison is the most dangerous of all. In their writings they have affirmed that, infecting with its poison almost all the vegetables of a large country, it might cause the destruction of whole nations. The moderns also, for a long time, believed the salamander to be very poisonous ; they have said that its bite is mortal, like that of the viper ; they have sought out and prescribed remedies for it ; but they have at length had recourse to observations, by which they ought to have begun. The celebrated Bacon wished that naturalists would endeavour to ascertain the truth respecting the poison of the salamander. Gesner proved by experiments that it did not bite, whatever means were used to irritate it ; and Wurfbanius shewed that it might safely be touched, and that we might, without danger, drink the water of those wells which it inhabited.

M. de Maupertuis studied also the nature of this lizard ; in making researches to discover what might be its pretended poison, he demonstrated, experimentally, that fire acted upon the salamander in the same manner as upon all other animals ; he remarked that it was scarcely upon the fire when it appeared to be covered with the drops

drops of its milk, which, rarefied by the heat, issued through all the pores of the skin, but in greater quantities from the head and dugs, and that it immediately became hard. It is needless to say that this milk is not sufficiently abundant to extinguish even the smallest fire.

M. de Maupertuis, in the course of his experiments in vain irritated several salamanders; none of them ever opened their mouths; he was obliged to open them by force. As the teeth of this lizard are very small, it was difficult to find an animal with a skin sufficiently fine to be penetrated by them: he tried, without success, to force them into the flesh of a chicken stripped of its feathers; he in vain pressed them against the skin; they were displaced, but they could not enter: he, however, made a salamander bite the thigh of a chicken after he had taken off a small part of the skin: he made salamanders, newly caught, bite also the tongue and lips of a dog, as well as the tongue of a turkey: but none of these animals received the least injury. M. de Maupertuis afterwards made a dog and a turkey swallow salamanders whole, or cut into pieces; and yet neither of them appeared sensible of the least uneasiness. Mr. Laurenti also has since
made

made experiments with the same view : he forced grey lizards to swallow the milk proceeding from the salamander, and they died very suddenly. The milk, therefore, of the salamander, taken internally, may hurt, and even be fatal to certain animals, especially those which are small; but it does not appear to be hurtful to large animals.

It was long believed that the salamander was of no sex, and that each individual had the power of engendering its like, the same as several species of worms. This is not the most absurd fable which has been imagined with respect to the salamander; but if the manner in which they come into the world be not so marvellous as has been written, it is remarkable in this, that it differs from that in which most other lizards are brought forth, as it is analogous to that in which the chalcyde and the seps, as well as vipers, and several kinds of serpents, are produced. On this account, the salamander merits the attention of naturalists much more than on account of the false and brilliant reputation which it has so long enjoyed. M. de Maupertuis having opened some salamanders, found eggs in them, and, at the same time, some young perfectly formed; the eggs were divided

divided into two long bunches like grapes, and the young were inclosed in two transparent bags; they were equally formed like the old ones, and much more active. The salamander, therefore, brings forth young from an egg hatched within its belly, as the viper; and her fecundity is very great: naturalists have long written that she has forty or fifty at a time; and M. de Maupertuis found forty-two young ones in the body of a female salamander, and fifty-four in another.

The young salamanders are generally of a black colour, almost without spots; and this colour they preserve sometimes during their whole lives, in certain countries, where they have been taken for a distinct species, as we have said. M. Thunberg has given, in the Memoirs of the Academy of Sweden, the description of a lizard, which he calls the Japanese lizard, and which appears to differ in nothing from our salamander but in the arrangement of its colours. This animal is almost black, with several whitish and irregular spots, both on the upper part of the body, and below the paws; on the back there is a stripe of dirty white, which becomes narrower to the point of the tail. This whitish stripe is interspersed with

very

very small specks, which form the distinguishing characteristic of our land salamander. We are of opinion, therefore, that we may consider this Japanese lizard, as a variety of the species of our land salamanders, modified a little, perhaps, by the climate of Japan; it is in the largest island of that empire, named Nippon, that this variety is found; it inhabits the mountains there, and rocky places. The Japanese consider it as a powerful stimulant, and a very active remedy; and on this account, in the neighbourhood of Jedo, a number of these Japanese salamanders may be seen dried, hanging from the ceilings of the shops.

The *Dragon* has been magnified into a terrific animal by authors of all ages, and to whom the most dreadful destructive powers have been applied: happily however no such animal, at present at least, is known to exist; and the only one of that name is a little harmless flying lizard, that preys upon insects, and even seems to embellish the forest with its beauty. Fable and superstition so long dwelt upon the description of the death-dealing dragon, that even to this day, the uncivilized people of Africa and America traverse the forests with terror, lest they should fall

fall into its power, and scarcely a savage is found that does not talk of serpents of an immoderate length flying away with a camel or rhinoceros, and who is capable of destroying mankind with a single glance.

The *Flying Lizard* of Java perches upon fruit trees, and feeds upon flies, ants, butterflies, and other small insects. It is a harmless creature, and does no injury in any respect. Gentil, in his voyage, says, he saw these lizards at the Island of Java in the East Indies. He observed that they flew very swiftly from tree to tree, and having killed one, he could not but admire the skin, which looked as if painted with several beautiful colours: it was a foot in length, and had four paws like the common lizards, but its head was flat, and had a small hole in the middle; the wings were very thin, and resembled those of a flying fish. About the neck were a sort of wattles, not unlike those of cocks, which gave it no disagreeable appearance. He intended to have preserved it, in order to bring it into Europe, but it was corrupted with the heat before the close of the day. Since his time, however, many have been brought into Europe.

The *Chalcidian Lizard*, of Aldrovandus, is very improperly called the *seps*, by modern historians. This animal seems to form the separating shade between the lizard and the serpent race. It has four legs, like the lizard; but so short, as to be utterly unserviceable in walking: it has a long slender body, like the serpent; and is said to have the serpent's malignity also. These animals are found about three feet long, and thick in proportion, with a large head and pointed snout. The whole body is covered with scales; and the belly is white, mixed with blue. It has four crooked teeth, as also a pointed tail, which, however, can inflict no wound. It is viviparous: upon the whole, it appears to bear a strong affinity to the viper; and, like that animal, its bite may be dangerous.

OF SERPENTS.

OF all classes of animals there is not one to which mankind have in general so strong an antipathy, as to those which we are now about to consider. Their deformity creates an aversion, and the venom which they possess, and their malignity, both horror and detestation. In vain has man endeavoured to destroy them: formidable in itself, it has checked pursuit, and, from its figure, being capable of effecting its escape, it has found security from those who were inclined to try the encounter, and therefore has still continued to breed in all parts of the world; but in none of the countries of Europe is the serpent tribe at present sufficiently numerous to be truly terrible. The various malignity also that has been ascribed to European serpents of old, is now utterly unknown; there are not above three or four kinds that are dangerous, and the poison of all

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operates

operates in the same manner. A burning pain in the part, easily removable by timely applications, is the worst effect that we experience from the bite of the most venomous serpents of Europe.

Though, however, Europe is happily delivered from these reptiles, yet in the warm countries that lie within the tropic, as well as in the cold regions of the north, where the inhabitants are few, the serpents propagate in equal proportion. All along the swampy banks of the river Niger, or Oroonoko, where the sun is hot, the forests thick, and the men but few, the serpents cling among the branches of the trees in infinite numbers, and carry on an unceasing war against all other animals in their vicinity. Travellers have assured us, that they have often seen large snakes twining round the trunk of a tall tree, encompassing it like a wreath, and thus rising and descending at pleasure. In these countries, therefore, the serpent is too formidable to become an object of curiosity; it excites more violent sensations.

We are not, however, to reject as wholly fabulous, the accounts left us by the ancients of the terrible devastations committed by a single serpent.

serpent. It is probable, that in early times, when the arts were little known, and mankind were but thinly scattered over the earth, serpents, continuing undisturbed possessors of the forest, grew to an amazing magnitude; and every other tribe of animals fell before them. To animals of this kind, grown by time and rapacity to a hundred, or a hundred and fifty feet in length, the lion, the tiger, and even the elephant itself, were but feeble opponents. The dreadful monster spread desolation around him; every creature that had life was devoured, or fled to a distance. In this manner, having for ages lived in the hidden and unpeopled forests, and finding, as their appetites were more powerful, the quantity of their prey decreasing, it is possible they might venture boldly from their retreats into the more cultivated parts of the country, and carry consternation among mankind, as they had before desolation among the lower ranks of nature. We have many histories of antiquity, presenting us such a picture; and exhibiting a whole nation sinking under the ravages of a single serpent. At that time man had not learned the art of uniting the efforts of many to effect one great purpose;

purpose; the animal was therefore to be opposed singly by him who had the greatest strength, the best armour, and most undaunted courage; in such encounters many must have fallen till one more fortunate than the rest might rid the country of its destroyer; and such was the original occupation of heroes. But as we descend into more enlightened antiquity, we find these animals less formidable, as being attacked in a more successful manner. We are told, that while Regulus led his army along the banks of the river Bagrada, in Africa, an enormous serpent disputed his passage across it. We are assured by Pliny, who says, that he himself saw the skin, that it was a hundred and twenty feet long, and that it had destroyed many of the army. At last, however, the battering engines were brought out against it; and these assailing it at a distance, it was soon destroyed. Its spoils were carried to Rome, and the general was decreed an *ovation* for his success; a kind of honour which was given for an exploit that was not of sufficient importance to merit a *triumph*. At present, indeed, such ravages from serpents are scarcely seen in any part of the world; not but in Africa and America there

there are some too powerful for man to hazard an attack, and from whom few beasts can escape, even at this day.

With respect to their conformation, all serpents have a very wide mouth, in proportion to the size of the head; and, what is very extraordinary, they can gape and swallow the head of another animal which is three times as big as their own. To explain this, it must be observed, that the jaws of this animal do not open as ours, in the manner of a pair of hinges, where bones are applied to bones, and play upon one another; on the contrary, the serpent's jaws are held together at the roots by a stretching muscular skin; whence they open as wide as the animal chuses to stretch them, and admit of a prey much thicker than the snake's own body. The throat, like stretching leather, dilates to admit the morsel; the stomach receives it in part; and the rest remains in the gullet, till putrefaction, and the juices of the serpent's body, unite to dissolve it.

As to the teeth, some serpents have fangs, or canine teeth, and others are without them. Their teeth are crooked and hollow, and by a peculiar contrivance, they are capable of being raised

raised or depressed at pleasure. Their eyes are small in proportion to the length of their bodies; they are of different colours, yet all have a malignant appearance. In some, the upper eye-lid is wanting, and the animal winks with the under one: others have a membranous skin, like that of birds, which preserves the sight: the substance of the eye is hard and horny, the crystalline humour occupying a great part. The holes for hearing are visible, but it is somewhat doubtful whether they possess the sense of smelling, as they do not appear to have any conduits for that purpose. The tongue in all these animals is long and forked. It is composed of two long, fleshy substances, which terminate in sharp points, and are very pliable. Some of the viper kind have tongues a fifth part the length of their bodies; they are continually darting them out, but they are entirely harmless, and only terrify those who are ignorant of the real situation of their poison.

The gullet is very wide for the size of the animal and capable of being greatly distended; at the bottom of this is the stomach, but which is by no means so capacious, and only receives a part of the prey, while the rest continues in the
gullet

gullet for digestion. When the substance in the stomach is dissolved into chyle, it passes into the intestines, and from thence goes to nourishment, or to be excluded by the vent.

The lungs of the serpent are long and large; and no doubt necessary to promote their languid circulation; but though they often appear to draw in their breath, yet there is not the smallest signs of its expiration. The heart is formed as in the tortoise, the frog, and the lizard kinds, so as to work without the assistance of the lungs; whence we are authorized to conclude that snakes are amphibious, equally capable of living on the land, or in the water; and that they are torpid in the winter, like the bat, the lizard, and several other animals.

The vent, in the serpents, serves for the emission of the urine, and fæces, and the purposes of generation; the organs for which, in the male, are double and forked, and the female has two ovaries. They copulate in their retreats, and the ancients have described them, in this situation, to resemble one snake with two heads; but of the truth of this we are unable to determine.

The joints in the back-bone are exceedingly numerous, which enable the creature to bend in any direction. In the generality of animals, these joints do not exceed thirty or forty; but in the serpent kind, they amount to one hundred and forty-five from the head to the vent, and twenty-five more from that to the tail. The number of these joints must give the back-bone a surprising degree of pliancy; but this is still increased by the manner in which each of these joints are locked into the other. In man and quadrupeds, the flat surfaces of the bones are laid one against the other, and bound tight by sinews, but in serpents, the bones play one within the other like a ball and socket, so that they have full motion upon each other in every direction. Though the number of joints in the back bone is so very great, yet that in the ribs is greater; for from the head to the vent, there are two ribs to every joint, which make their number two hundred and ninety. These ribs are furnished with four muscles; which being inserted in the head, run along to the end of the tail, and give the animal great strength and agility in all its motions.

The skin is composed of a number of scales, united to each other by a transparent membrane, which

which grows harder as it grows older, until the animal changes, which it usually does twice a year. This cover then bursts near the head, and the serpent creeps from it, by an undulatory motion, in a new skin, much more vivid than the former. As the edges of the foremost scales lie over the ends of their following scales, so those edges, when the scales are erected, which the animal has a power of doing in a small degree, catch in the ground, like the nails in the wheel of a chariot, and so promote and facilitate the animal's progressive motion. The erecting of these scales is by means of a multitude of distinct muscles, with which each is supplied, and one end of which is tacked to the middle of each of the foregoing.

In the form and disposition of scales there is a great difference in the different kinds; some have them disposed with exact symmetry, while in others they are very irregularly placed; some have large scales on the belly, others smaller, and often answering in number to that of the ribs, while some are entirely without them. But when we come to compare serpents with each other, the first great distinction appears in their size; for the great *lyboya* of Surinam frequently grows to

the length of thirty-six feet; while the little serpent of the Cape of Good Hope seldom exceeds three inches; of which kind there are such numbers to the north of the river Senegal, that they cover whole sandy desarts with their multitudes.

This tribe of animals, like that of fish, seems to have no bounds put to their growth: their bones are in a great measure cartilaginous, and they are consequently capable of great extension; the older, therefore, a serpent becomes, the larger it grows; and as they seem to live to a great age, they arrive at an enormous size.

Leguat assures us, that he saw a serpent in Java that was fifty feet long; and Carli mentions their growing above forty feet. Mr. Wentworth, who had large concerns in the Brebices in America, assures us, that in that country, they grow to an enormous length. He one day sent out a soldier, with an Indian, to kill wild-fowl for the table; and they accordingly went some miles from the fort: in pursuing their game, the Indian, who generally marched before, beginning to tire, went to rest himself upon the fallen trunk of a tree, as he supposed it to be; but when he was just
going

going to sit down, the enormous monster began to move, and the poor savage, perceiving that he had approached a lyboya, the greatest of all the serpent kind, dropped down in an agony. The soldier, who beheld at some distance what had happened, levelled at the serpent's head, and, by a lucky aim, shot it dead; he continued however, his fire, until he was assured that the enemy was killed; and then going up to rescue his companion, who had fallen motionless by its side, he, to his astonishment, found him dead likewise, being killed by the fright. Upon his return to the fort, and telling what had happened, Mr. Wentworth ordered the animal to be brought up, when it was measured, and found to be thirty-six feet long. He had it stuffed, and sent as a present to the Prince of Orange, who deposited it in his cabinet at the Hague.

In the East Indies they grow also to an enormous size; particularly in the island of Java, where, we are assured, that one of them will destroy and devour a buffalo. In a letter printed in the German Ephemerides, we have an account of a combat between an enormous serpent and a buffalo, by a person, who assures us, that he was himself a spectator. The serpent had,
for

for some time, been waiting near the brink of a pool, in expectation of its prey; when a buffalo was the first that offered. Having darted upon the affrighted animal, it instantly began to wrap it round with its voluminous twistings; and at every twist the bones of the buffalo were heard to crack almost as loud as the report of a cannon. It was in vain that the poor animal struggled and bellowed, its enormous enemy was entwined round it too closely to get free; till at length all its bones being mashed to pieces, like those of a malefactor on the wheel, and the whole body reduced to one uniform mass, the serpent untwined its folds to swallow its prey at leisure. To prepare for this, and in order to make the body slip down the throat more glibly, it was seen to lick the whole body over, and thus cover it with its mucus. It then began to swallow it at that end that offered least resistance; while its length of body was dilated to receive its prey, and thus took in a morsel at once that was three times its own thickness. We are also assured by travellers, that these animals are often found with the body of a stag in their gullet, while the horns, which they are unable to swallow, keep sticking out at their mouths.

But

But happily for mankind, the rapacity of these frightful creatures is often their punishment; for, whenever any of the serpent kind have gorged themselves in this manner, and their body is seen particularly distended with food, they then become torpid, and may be approached and destroyed with safety. They generally, after having surfeited themselves with their prey, seek some retreat, where they lurk for several days together, and remain unwieldy, stupid, helpless and sleepy; the smallest effort is capable of destroying them; they can scarcely make any resistance; they are equally unqualified for flight or opposition; and even the naked Indian does not then fear to assail them.

Carli describes having seen a long serpent of Congo, making its track through the tall grass, like mowers in a summer's day. He says he could not without terror behold whole lines of grass lying levelled under the sweep of its tail; it moved forward in that manner with great rapidity, until it found a proper situation frequented by its prey; there it continued to lurk in patient expectation, and would have remained for weeks together, had it not been disturbed by the natives.

Other

Other creatures have a choice in their provision ; but the serpent has none ; he preys indiscriminately upon the buffalo, the tiger, and the gazelle. One would think that the porcupine's quills would be sufficient to protect it ; but whatever has life serves to appease the hunger of these devouring creatures : porcupines, with all their quills, have frequently been found in their stomachs, when killed and opened ; nay, they are often seen to devour each other.

When in pursuit of their prey, they are most indefatigable ; they may be said to be ever on the watch, as they sleep with their eyes open ; and from its venom and power, scarcely any animal dare dispute with them a prize until their rapacity is satisfied.

But though these animals are, above all others, the most voracious ; and though the morsel which they swallow without chewing, is greater than what any other creature, either by land or water, the whale itself not excepted, can devour, yet no animals upon earth bear abstinence so long as they. A single meal, with many of the snake kind, seems to be the adventure of a season ; and is an occurrence for which

which they have been for weeks, nay, sometimes for months, in patient expectation of; and the fortunate capture of an hour is often sufficient to serve them for the period of their annual activity. Their prey continues for a long time, partly in the stomach, partly in the gullet; and a part is often seen hanging out of the mouth. In this manner it digests by degrees; and in proportion as the part below is dissolved, the part above is taken in. It is not therefore till this tedious operation is entirely performed, that the serpent renews its appetite and its activity. But should any accident prevent it from issuing once more from its cell, it still can continue to bear famine for weeks, months, nay, for years together. Vipers are often kept in boxes for six or eight months, without any food whatever; and there are little serpents sometimes sent over to Europe, from Grand Cairo, that live for several years in glasses, and never eat at all, nor even stain the glass with their excrement. Thus the serpent tribe unite in themselves two very opposite qualities; wonderful abstinence, and yet incredible rapacity.

With respect to the voices of these animals, some of them have a peculiar shriek, and some

are silent, but hissing is the sound which they most commonly send forth, either as a call to their kind, or as a threat to their enemies. In the hot climates, in which they most abound, they are never heard in the middle of the day, but as soon as the cool of the evening approaches, they issue from their cells with continued hissings.

Some serpents in their motions, particularly those of the viper kind, move very slowly, while others, such as the ammodytes, dart with amazing swiftness. Their method of getting forward is nearly similar in all; the viper makes way in a heavy, undulating manner, advancing its head, then drawing up its tail behind, and bending the body into a bow; then, from the spot where the head and tail are brought together, advancing the head forward as before; this bending the body into an arch seems to be the motion of most serpents; but there are many which dart with such amazing swiftness, that they rather appear to leap than advance in that manner. It is most probable, however, that no serpent can dart upon a level surface farther than its own length at one effort, though it has been asserted by some, that they will dart to a great distance; but this we rather apprehend to have arisen from apprehension of the consequences

quences of its approach. The manner of progression in the jaculus, which is supposed to move the quickest of any other, is by suddenly rising upon its tail, and darting from thence to its full extent; then carrying the tail instantaneously to the head, rising, and darting again; by which means it proceeds with wonderful rapidity, without ever quitting the ground. When we consider that, in the whole tribe of serpents, the back-bone is very long and weak, and the whole body composed of unsupported muscles, and joints that are yielding, we cannot suppose them to possess the power of springing from the ground.

All serpents are amphibious, yet some are much more partial to water than others; and though destitute of fins and gills, remain at the bottom, or swim along the surface with great ease. It is in fresh-water alone, however, that they can live, as the salt is an effectual bane to the whole tribe. The greatest serpents are usually found in the water, either chusing it as their favourite element, or finding their prey in such places in greatest abundance. An experiment of Rhedi proves that they will all live and swim in liquids; that naturalist put a

serpent into a large glass vessel of wine, where it swam about for six hours; but being immersed and kept under that liquid by force, it lived only an hour and a half. He put another in common water, where it lived three days; but on being kept under water, it died in about twelve hours. Their motion in the water is quite different to what it is on land; in the former they move their bodies backward and forward, from the right to the left, but on the latter it is simply up and down.

Some serpents have a most horrible foetor attending them, which is alone capable of intimidating the brave. This proceeds from two glands near the vent, like those in the weasel and pole-cat; and, like those animals, in proportion as they are excited by rage or by fear, the scent grows stronger. It would seem, however, that such serpents as are most venomous are least offensive in this particular; since the rattle-snake and the viper have no smell whatever: nay, we are told that at Calecut and Cranganor, in the East Indies, there are some very noxious serpents, who are so far from being disagreeable, that their excrements are sought after, and kept as the most pleasing perfume. The æsculapian serpent is also of this number.

Some

Some serpents bring forth their young alive as the viper; some bring forth eggs, which are hatched by the heat of their situation as the common black snake, and the majority of the serpent tribe. When a reader, ignorant of anatomy, is told, that some of those animals produce their young alive, and that some produce eggs only, he is apt to suppose a very great difference in the internal conformation, which makes such a variety in the manner of bringing forth. But this is not the case; these animals are internally alike, in whatever manner they produce their young; and the variety in their bringing forth, is rather a slight than a real discrimination. The only difference is, that the viper hatches her eggs, and bring them to maturity within her body; the snake is more premature in her productions, and sends her eggs into the light sometime before the young ones are capable of leaving the shell. Thus, if either be opened, the eggs will be found in the womb, covered with their membranous shell, and adhering to each other, like large beads on a string. In the eggs of both, the young one will be found, though at different stages of maturity: those of the viper will crawl and bite the moment the shell that encloses

encloses them is broken open; those of the snake are not yet arrived at their perfect form.

Father Labat took a serpent of the viper kind, that was nine feet long, and ordered it to be opened in his presence. He then saw the manner in which the eggs of these animals lie in the womb. In this creature there were six eggs, each of the size of a goose egg, but longer, more pointed, and covered with a membranous skin, by which also they were united to each other. Each of these eggs contained from thirteen to fifteen young ones, about six inches long, and as thick as a goose-quill. These little mischievous animals were no sooner let loose from the shell than they crept about, and put themselves into a threatening posture, coiling themselves up, and biting the stick with which he was destroying them. In this manner he killed seventy-four young ones; those that were contained in one of the eggs escaped from the place where the female was killed, by the bursting of the egg, and their getting among the bushes.

The most material distinction among serpents is that some are venomous and some inoffensive. Of the poison of these animals much has been said; the various calamities that it is
capable

capable of producing are not only inflicted by the animal itself, but by men, more mischievous even than serpents, who prepare their venom to destroy each other. With this the savages poison their arms, and also prepare their revengeful potions; the ancients were known to preserve it for the purposes of suicide; and among some barbarians, the venom of snakes is used as a philtre to this day. But though their poison is justly terrible to us, it has been given to very good purposes for the animal's own support and defence. Without this, serpents, of all animals, would be the most exposed and defenceless; unable to inflict wounds, or to escape by speed, they would have been the prey of all; but from being furnished with a powerful poison, every rank of animals approaches them with dread, and never seize them but at an advantage. Nor is this all; for the malignity of a few serves as a protection for the whole. Though not above one tenth of their number are actually venomous, yet the similitude they all bear to each other, excites a general terror of the whole tribe; and thus the uncertainty in which the poison resides, renders even the most harmless formidable.

Form these noxious qualities in the serpent kind, it is no wonder that not only man, but even beasts and birds carry on unceasing war against them. The ichneumon of the Indians, and the peccary of America, destroy them in great number. These animals have the art of seizing them near the head; and it is said that they can skin them with great dexterity. The vulture and the eagle also prey upon them in great abundance; and often sousing down from the clouds, drop upon a long serpent, which they snatch up struggling and writhing in the air. Dogs also are bred up to oppose them.

Father Feuillée tells us, that being in the woods of Martinico, he was attacked by a large serpent, which he could not easily avoid, when his dog immediately came to his relief, and seized the assailant with great courage. The serpent twined round him, and pressed him so violently, that the blood came out of his mouth, and yet the dog never ceased till he had torn it to pieces. The dog was not sensible of his wounds during the fight; but soon after his head swelled prodigiously, and he lay on the ground as dead. But his master having found, close by, a banana-tree, he applied its juice,
mixed

mixed with treacle, to the wounds; which recovered the dog, and quickly healed his sores.

The Psylli, of old, were famous for charming and destroying serpents; and Cassauban says, that he knew a man who could at any time summon a hundred serpents together, and draw them into the fire, and that on a particular time, when a large one refused to obey, he only repeated his charm, and it came forward, like the rest, to submit to the flames. Philostratus says, that the Indians charm serpents in the following manner: "they take a scarlet robe, embroidered with golden letters, and spread it before a serpent's hole; the golden letters have a fascinating power, and by looking stedfastly, the serpent's eyes are overcome, and laid asleep."

In India there is nothing so common as dancing serpents, which are carried about in a broad flat vessel resembling a sieve. These erect and put themselves into motion at the word of command. When their keeper sings a slow tune, they seem by their heads to keep time; when he sings a quicker measure, they appear to move more brisk and lively. All animals have a certain degree of docility; and

we find that serpents themselves can be brought to move and approach at the voice of their master. From this trick successfully practised before the ignorant, it is most probable that all the boasted pretensions which some have made to charming of serpents have arisen; an art to which the native Americans pretend at this very day.

OF VENOMOUS SERPENTS.

IN all countries, the poison of the serpent is sufficiently formidable to deserve notice, and to excite our attention to its nature and effects. It will therefore, be proper in the first place, to describe its seat in the animal, as also the instrument by which the wound is made and the poison injected. In all this venomous class of reptiles, whether the viper, the rattle-snake, or the *cobra di capello*, there are two large teeth or fangs that issue from the upper-jaw, and

and that hang out beyond the other. The rest of the snake tribe are destitute of these; and it is most probable, that wherever these fangs are wanting, the animal is harmless; on the contrary, wherever they are found, it is to be avoided as the most pestilent enemy. Our first great attention, therefore, upon seeing a serpent, should be directed to the teeth. If it have the fang teeth, it is to be avoided as venomous, and if without them, it may be considered as inoffensive; for although some of the latter have been set down as dangerous, yet not one of the whole tribe which has not fangs has a bag for containing the poison, or a conduit for ejecting it into the wound. The black snake, the liboya, the blind worm, and a hundred others that might be mentioned, have their teeth of an equal size, and with no other apparatus for inflicting a dangerous wound than a dog or a lizard: but it is otherwise with the venomous kind; these are all furnished, not only with an elaboratory, situated behind the head on each side of the eyes, where the poison is formed, but a canal, by which it is conducted to the jaw, a bag under the tooth for keeping it ready, and also an aperture in the tooth itself for injecting it into the

N 2

wound.

wound. The venom contained in this bag is a yellowish, thick, tasteless liquor, which injected into the blood is death, but which may be swallowed without any danger.

The fangs that give the wound are large in proportion to the size of the animal that bears them; crooked, yet sharp enough to inflict a ready wound. They grow one on each side, and sometimes two from two moveable bones in the upper jaw, which, by sliding backward or forward, have a power of erecting or depressing the teeth at pleasure. In these bones are also fixed many teeth, but no way venomous, and only serving to take and hold the animal's prey. If a viper inflict a wound, and the remedy be neglected, the symptoms are not without danger. It first causes an acute pain in the place affected, attended with a swelling, first red, and afterwards livid, and which, by degrees, spreads to the neighbouring parts. To this succeed great sickness at the stomach, bilious and convulsive vomitings, cold sweats, pains about the navel, and death itself. These symptoms are much more violent, and succeed each other more rapidly after the bite of a rattle-snake; but when the person is bitten by the cobra di capello, he dies in an hour, his whole

whole frame being dissolved into a putrid mass of corruption.

It has hitherto remained a matter of astonishment that so small a quantity of matter should produce such sudden, powerful, and deadly effects, for the venom has not the smallest acrid taste, and from all experiments that have been made it appears only a slimy insipid fluid. Charas, who often tasted it, assures us of the fact, and asserts, that it may be taken inwardly without any sensible effects, or any prejudice to the constitution. But the famous experiments that were tried by Rhedi, and others, in the presence of the Great Duke of Tuscany and his court, put this beyond any doubt whatsoever. By these it appeared, that the serpent having once bitten, exhausted for that time the greatest part of its poison; and though the wound caused by its biting a second time was attended with some malignant symptoms, yet they were much milder than before. It appeared also that the serpent biting upon a sponge, or a piece of soft bread, and then biting a dog immediately after, did not inflict a wound more dangerous than the prick of a needle. It appeared that the venom being collected, and a needle dipped in it, the wound made by that produced almost as painful effects

effects as those by the tooth of the animal itself. But what caused the greatest surprize in the court was the seeming rashness of one *Tozzi*, a viper-catcher; who, while the philosophers were giving elaborate lectures on the danger of the poison when taken internally, boldly desired that a large quantity of it might be put together, and then with the utmost confidence drank it of before them all. The court was struck with astonishment, and expected that the man would instantly fall dead; but they soon perceived their mistake, and found that taken in this manner the poison was as harmless as water. In support of this seeming contradiction that the venom of serpents should be perfectly harmless if taken inwardly, and yet so fatal if ejected into the circulation, we need only observe that milk, though one of the most mild and nourishing of all fluids, and seemingly the most friendly to the human constitution, yet if milk be injected into a vein, it will quickly become fatal, and kill with as much certainty as the venom of a viper. Hence then we may infer, that the introduction of a quantity of any mixture into the circulation would be fatal; and that consequently, serpents kill as well by their power of injecting their poison into the wound

as

as by the malignant potency with which it is impregnated.

Ray relates the following instance of the powerful effects of the poison, but the veracity of which many have doubted. “ A gentleman
“ who went over to the East Indies, while
“ he was one day sitting among some friends,
“ was accosted by an Indian juggler, who
“ offered to shew him some experiments respecting the venom of serpents; an exhibition usual enough in that country. Having
“ first, therefore, produced a large serpent,
“ he assured the company that it was harmless; and to convince them of what he said,
“ he tied up his arm, as is usual with those
“ who are going to be bled, and whipped the
“ serpent until it was provoked to bite him.
“ Having drawn, in this manner, about half a
“ spoonful of blood from his arm, he put the
“ congealed clot upon his thigh. He then took
“ out a much smaller serpent, which was no
“ other than the cobra di capello; and having
“ tied up its neck, he procured about half a
“ drop of its venom, which he sprinkled on the
“ clot of blood on his thigh, which instantly began to ferment and bubble, and soon changed
“ colour from a red into a yellow.”

Whether this were really the case, or that the Indian made use of some artifice to surprise his spectators, it is of little consequence, for the fatality of the serpents poison is too well known. It is very seldom that any of this malignant kind are seen to exceed nine feet in length; their food chiefly consists of small prey, such as birds, moles, toads, and lizards, and they never commence an attack with any formidable animal with whom they are likely to have a serious encounter. They lurk in the clefts of rocks, or among stony places; they entwine round the branches of trees, or bask themselves in the sun among the long grass at the bottom. There they only seek repose and safety; and if some unwary traveller happen to invade their retreats, their first effort is to fly; but when either pursued or accidentally trod upon, they then make a fierce and fatal resistance. For this purpose they raise themselves upon their tail, erect their head, and seize whatever presses them; the wound is given and the head withdrawn in a moment. And this is probably one reason why the Asiatics, who live in regions where serpents greatly abound, wear boots and long clothes, as they are by that means in some measure protected from the resentments of these reptile annoyers.

In

In the East and West Indies the number of noxious serpents is various; in this country we are acquainted only with one. The viper is the only animal in Great Britain from whose bite we have any thing to fear. In the tropical climates, the rattle-snake, the whip-snake, and the cobra di capello, are the most formidable. From the general notoriety of the particular serpents, and the universal terror which they occasion, it would seem that few others are possessed of such powerful malignity.

Vipers are found in many parts of Europe; but the dry, stony, and in particular the chalky countries abound with them. This animal seldom grows to a greater length than two feet; though sometimes they are found above three. The ground colour of their bellies is a dirty yellow; that of the female is deeper. The whole length of the back is marked with a series of rhomboid black spots, touching each other at the points; the sides with triangular ones, the belly entirely black. It is chiefly distinguished from the common ringed snake by the colour, which in the latter is more beautifully mottled, as well as by the head, which is thicker than the body; but particularly by the tail, which, in the viper, though it ends in a point, does

not run tapering off to so great a length as in the other. When, therefore, other distinctions fail, the difference of the tail can be discerned at a single glance.

The viper differs from most other serpents in being much slower, as also in excluding its young completely formed, and bringing them forth alive. The kindness of Providence seems to be exerted not only in diminishing the speed, but also the fertility, of this dangerous creature. They copulate in May, and are supposed to be about three months before they bring forth, and have seldom above eleven eggs at a time. These are of the size of a blackbird's egg, and chained together in the womb like a string of beads. Each egg contains from one to four young ones; so that the whole of a brood may amount to about twenty or thirty. They continue in the womb till they come to such perfection as to be able to burst from the shell; and they are said to creep from their confinement into the open air by their own efforts, where they continue for several days without taking any food whatever.

Mr. Pennant says, "We have been often assured by intelligent people, of the truth of a fact, that the young of a viper, when terrified,

“rifed, will run down the throat of the pa-
“rent, and seek shelter in its belly in the same
“manner as the young of the opossum retire
“into the ventral pouch of the old one. From
“this some have imagined that the viper is so
“unnatural as to devour its own young, but
“this deserves no credit, as these animals live
“upon frogs, toads, lizards, and young birds,
“which they often swallow whole, though the
“morsel is often three times as thick as their
“own body.”

The viper is capable of supporting very long abstinence, it being a well ascertained fact that some have been kept in a box six months without food; yet during the whole time their vivacity was not abated. They feed only a small part of the year, but never during their confinement; for if mice, their favourite diet, should at that time be thrown into their box, though they will kill, yet they will never eat them. When at liberty, they remain torpid throughout the winter; yet, when confined, they have never been observed to take their annual repose.

They are usually taken with wooden tongs, by the end of the tail, which may be done without danger; for, while held in that position, they

they are unable to wind themselves up to hurt their enemy: yet, notwithstanding this precaution, the viper-catchers are often bitten by them; but, by the application of olive-oil, the effect is safely obviated.

“ William Oliver, a viper-catcher, at Bath,
“ was the first who discovered this admirable
“ remedy. On the first of June, 1735, in the
“ presence of a great number of persons, he
“ suffered himself to be bit by an old black
“ viper, brought by one of the company, upon
“ the wrist, and joint of the thumb of the right
“ hand, so that drops of blood came out of
“ the wounds: he immediately felt a violent
“ pain, both at the top of his thumb, and up
“ his arm, even before the viper was loosened
“ from his hand; soon after he felt a pain,
“ resembling that of burning, trickle up his
“ arm; in a few minutes his eyes began to
“ look red and fiery, and to water much; in
“ less than an hour he perceived the venom
“ seize his heart, with a pricking pain, which
“ was attended with faintness, shortness of
“ breath, and cold sweats; in a few minutes
“ after this, his belly began to swell, with
“ great gripings, and pains in his back, which
“ were attended with vomitings and purging;
“ during

“ during the violence of these symptoms, his
“ sight was gone for several minutes, but he
“ could hear all the while. He said that in
“ his former experiments he had never de-
“ ferred making use of his remedy longer than
“ he perceived the effects of the venom reached
“ his heart; but this time, being willing to
“ satisfy the company thoroughly, and trust-
“ ing to the speedy effects of his remedy,
“ which was nothing more than olive oil, he
“ forebore to apply any thing till he found him-
“ self exceedingly ill, and quite giddy; in
“ about an hour and a quarter after the first
“ of his being bit, a chaffing dish of glowing
“ charcoal was brought in, and his naked
“ arm was held over it as near as he could
“ bear, while his wife rubbed in the oil with
“ her hand, turning his arm continually round,
“ as if she would have roasted it over the
“ coals: he said the poison soon abated, but
“ the swelling did not diminish much. Most
“ violent purgings and vomitings soon ensued;
“ and his pulse became so low, and so often in-
“ terrupted, that it was thought proper to or-
“ der him a repetition of cordial potions; he
“ said he was not sensible of any great relief
“ from these; but that a glass or two of olive
“ oil,

oil drank down, seemed to give him ease. Continuing in this dangerous condition, he was put to-bed, where his arm was again bathed over a pan of charcoal, and rubbed with olive oil, heated in a ladle over the charcoal, by Dr. Mortimer's directions, who was the physician that drew up the account. From this last operation he declared that he found immediate ease, as though by some charm: he soon after fell into a profound sleep, and, after about nine hours sound rest, awaked about six the next morning, and found himself very well; but in the afternoon, on drinking some rum and strong beer, so as to be almost intoxicated, the swelling returned, with much pain and cold sweats, which abated soon, on bathing the arm as before, and wrapping it up in a brown paper soaked in the oil."

Notwithstanding that the bite of the viper is attended with such dreadful effects, its flesh has long been esteemed for its medicinal virtues; a broth made by boiling a viper in water, which just covers it, until it comes to half the quantity, is a powerful restorative in battered constitutions. The salt of vipers is also thought to exceed any other animal salt whatever, in giving

giving vigour to a languid constitution, and prompting to venery.

The *Rattle-snake* is bred in America, and in no part of the old world. Some are as thick as a man's leg, and six feet in length; but the most usual size is from four to five feet long. It resembles in most particulars the viper: having like that animal a large head, and a small neck, and furnished with fangs that inflict the most terrible wounds. It differs, however, in having a large scale, which hangs like a penthouse over each eye. They are of an orange tawny, and blackish colour on the back; and of an ash colour on the belly, inclining to lead. The male may be readily distinguished from the female, by a black velvet spot on the head, and the head being smaller and longer. But that which, besides their superior malignity, distinguishes them from all other animals, is their rattle, an instrument lodged in their tail, by which they make such a loud rattling noise, when they move, that their approach may readily be perceived, and the danger avoided. This rattle, which is placed in the tail, somewhat resembles, when taken from the body, the curb chain of a bridle: it is composed of several thin, hard, hollow

low bones, linked to each other, and rattling upon the slightest motion. It is supposed by some, that the snake acquires an additional bone every year, and that, from this, its age may be precisely known: however this may be, certain it is, that the young snakes, or those a year or two old, have no rattles at all; while many old ones have been killed, that had from eleven to thirteen joints each. They shake and make a noise with these rattles with prodigious quickness when they are disturbed; the peccary and the vulture however are no way terrified at the sound, but hasten, at the signal, to seize the snake, as their most favourite prey.

It is very different with almost every other animal. The certain death which ensues from this creature's bite, makes a solitude wherever it is heard. It moves along with the most majestic rapidity; neither seeking to offend the larger animals, nor fearing their insults. If unprovoked, it never meddles with any thing but its natural prey; but when accidentally trodden upon, or pursued to be destroyed, it then makes an able and desperate defence. It erects itself upon its tail, throws back the head, and inflicts its wound in a moment; then parts, and inflicts a second wound: after which, we are told

told by some, that it remains torpid and inactive, without even attempting to escape.

The very instant the wound is inflicted, though small in itself, it appears more painful than the sting of a bee. This pain, which is so suddenly felt, far from abating, grows every moment more excruciating and dangerous; the limb swells; the venom reaches the head, which is soon of a monstrous size; the eyes are red and fiery; the heart beats quick, with frequent interruptions: the pain becomes insupportable, and some expire under it in five or six hours; but others, who are of stronger constitutions, survive the agony for a few hours longer only to sink under a general mortification which ensues, and corrupts the whole body.

It is related by Goldsmith, that, “ As a gentleman in Virginia was walking in the fields
“ for his amusement, he accidentally trod upon
“ a rattle-snake that had been lurking in a
“ stony place, which, enraged by the pressure,
“ reared up, bit his hand, and shook its rattles.
“ The gentleman readily perceived that
“ he was in the most dreadful danger; but unwilling
“ to die unrevenged, he killed the
“ snake, and carrying it home in his hand,
“ VOL. V. P “ threw

“ threw it on the ground before his family,
“ crying out, I am killed, and there is my
“ murderer! In such an extremity, the speediest
“ remedies were the best. His arm,
“ which was beginning to swell, was tied up
“ near the shoulder, the wound was anointed
“ with oil, and every precaution taken to stop
“ the infection. By the help of a very strong
“ constitution he recovered, but not without
“ feeling the most various and dreadful symptoms
“ for several weeks together. His arm
“ below the ligature, appeared of several colours,
“ with a writhing among the muscles,
“ that, to his terrified imagination, appeared
“ like the motions of the animal that had
“ wounded him. A fever ensued; the loss of
“ his hair, giddiness, drought, weakness, and
“ nervous faintings; till, by slow degrees, a
“ very strong habit overpowered the latent
“ malignity of the poison.”

The rattle-snake has been described by some authors, as being very quick in its motions, while others on the contrary, as strongly contend that it is the slowest of all the serpent kind, and to which latter opinion we are most inclined to give credit, from its perfect similarity in all other respects to the viper. This creature has also been

been said to possess the power of charming its prey into its mouth, and that the inhabitants of Pennsylvania have daily opportunities of observing the strange fascination. The circumstance has been thus related: " This snake is
" often seen basking at the foot of a tree where
" birds and squirrels make their residence:
" there coiled upon its tail, its jaws extended,
" and its eyes shining like fire, it levels its
" dreadful glare upon one of the little animals
" above. The bird, or the squirrel, which-
" ever it may be, too plainly perceives the mischief meditating against it, and hops from
" branch to branch, with a timorous, plaintive
" sound, wishing to avoid, yet incapable of
" breaking through the fascination; thus it
" continues for some time its feeble efforts and
" complaints, but is still seen approaching
" lower towards the bottom branches of the
" tree, until at last, as if overcome by the potency of its fears, it jumps down from the
" tree into the throat of its frightful destroyer.
" In order, says the same author, to ascertain
" the truth of this story, a mouse was put into
" a large iron cage, where a rattle-snake was
" kept, and the effect carefully observed. The
" mouse remained motionless at one end of the

“ cage, while the snake at the other continued
“ fixed, with its eyes glaring full on the little
“ animal, and its jaws opened to their widest
“ extent: the mouse, for some time, seemed
“ eager to escape: but every effort only served
“ to encrease its terrors, and to draw it still
“ nearer the enemy, till, after several ineffec-
“ tual attempts to break the fascination, it was
“ seen to run into the jaws of the rattle-snake,
“ where it was instantly killed.”

Both this story however and that of the serpent's possessing such a fascinating property, has been greatly doubted; and by way of proving its improbability, it has been as roundly asserted by others, that if the snake be put into confinement, so far from opening its mouth for the prey to run in, it refuses all kind of food, and will absolutely die for want of nourishment.

A serpent, called the *Whip-snake*, is still more venomous than the former. This animal, which is a native of the East, is about five feet long, yet not much thicker than the thong of a coachman's whip. It is exceedingly venomous; and its bite is said to kill in about six hours. One of the Jesuit missionaries happening to enter into an Indian pagoda, saw what he took to be a whip-cord lying on the floor,

floor, and stooped to take it up; but, what was his surprise upon touching it to find that it was animated, and no other than the whip-snake, of which he had heard such formidable accounts. Fortune, however, seemed favourable to him; for he grasped it by the head, so that it had no power to bite him, and only twisted its folds up his arm. In this manner he held it, till it was killed by those who came to his assistance.

To this formidable class might be added the *Asp*, whose bite, however, is not attended with those drowsy symptoms, which the ancients ascribed to it. The *Jaculus* of Jamaica is also one of the swiftest of the serpent kind. The *Hæmorrhois*, so called from the hæmorrhages which its bite is said to produce; the *Seps*, whose wound is very venomous, and causes the part affected to corrupt in a very short time; the *Coral Serpent*, which is red, and whose bite is said to be fatal. But the *Cobra dâ Capello*, or Hooded Serpent, inflicts the most deadly and incurable wounds. Of this formidable creature, there are five or six different kinds; but they are all equally dangerous, and their bite is followed by speedy and certain death. It is from three to eight feet long, with two large fangs

fangs hanging out of the upper jaw. It has a broad neck, and a mark of dark brown on the forehead, which, when viewed frontwise, looks like a pair of spectacles; but behind, like the head of a cat. The eyes are fierce, and full of fire; the head is small, and the nose flat, though covered with very large scales, of a yellowish ash colour; the skin is white; and the large tumour on the neck is flat, and covered with oblong, smooth scales.

From the fatal effects of the venom of these animals, it was natural for constant researches to be made to discover an antidote, but hitherto they have been ineffectual, at least with any degree of certainty; though there are frequent instances of relief being obtained by an application of the Virginian snake-root; and the head of the animal bruised and laid upon the part affected, has been thought to assist in the cure: salad oil is also reckoned very efficacious; and the Indians make use of a composition, called the serpent's stone, which has the property of sticking to the skin of the injured part, and will draw out the blood; yet, in general, it is painful to remark, that the poison baffles every effort; and of which the rude Indians are so sensible,

sensible, that they always dip their arrows in the poison under their fangs, when they desire to take a certain revenge on their enemies.

OF SERPENTS WITHOUT VENOM.

THE whole of this class of serpents may be in a great measure distinguished from the preceding by their entire want of the fang teeth, by their heads being less in proportion to their bodies, and in general by their tapering off to the tail more gradually in a point. Their teeth are short, numerous, and in the smaller kinds perfectly inoffensive; they lie in both jaws as in frogs and fish, their points bending backwards, the better to secure their prey. They also want the artificial mechanism by which the poisonous tribe inflict such deadly wounds: they have no gland in the head for preparing venom; no conduits for conveying it to the teeth; no receptacles there; no hollow in the instrument that inflicts the wound. Their bite, when the teeth happen to be large enough to penetrate the

the skin, (for in general they are too small for this purpose,) is attended with no other symptoms than those of an ordinary puncture: and many of this tribe, as if sensible of their own impotence, cannot be provoked to bite, though ever so rudely assaulted. They hiss, dart out their forky tongues, erect themselves on the tail, and call up all their terrors to intimidate their aggressors, but seem to consider their teeth as unnecessary instruments of defence, and never attempt to use them. Even among the largest of this kind, the teeth are never employed, in the most desperate engagements. When a hare or a bird is caught, the teeth may serve to prevent such small game from escaping; but, when a buffalo or a tiger is to be encountered, it is by the strong folds of the body, by the fierce verberations of the tail, that the enemy is destroyed: for, twining round, and drawing the knot with convulsive energy, this enormous reptile breaks every bone in the quadruped's body, and then, at one morsel, devours it.

Hence we may distinguish the unvenomous tribe into two kinds; first, into those which are seldom found of any considerable magnitude, and that never offend animals larger or more powerful.

powerful than themselves, but which find their chief protection in flight, or in the doubtfulness of their form; secondly, into such as grow to an enormous size, fear no enemy, but indiscriminately attack all other animals, and devour them. Of the first kind is the common *Ringed snake*, the *Blindworm*, the *Esculapian serpent*, the *Amphisbæna*, and several others. Of the second the *Jiboya*, the *Boiguacu*, the *Depona*, and the *Boiquatrara*.

The *Ringed Snake*, or as it is sometimes called the *Black Snake*, is the largest of English serpents, sometimes exceeding four feet in length. The neck is slender, the middle of the body thick, the back and sides covered with small scales; the belly with oblong, narrow, transverse plates; the colour of the back and sides is of a dusky brown; the middle of the back marked with two rows of small black spots, running from the head to the tail; the plates on the belly are dusky; the scales on the sides are of a bluish white; the teeth are small and serrated, lying on each side of the jaw, in two rows. The whole species is perfectly inoffensive, taking shelter in dunghills, and among bushes in moist places; whence they seldom remove, unless in the midst of the day, in summer, when

they are called out by the heat, to bask themselves in the sun. If attacked they at first endeavour to escape, but if much pressed they begin to hiss and put themselves into a threatening position, though incapable of doing mischief.

This snake preys upon frogs, insects, worms, mice, and young birds; and, considering the smallness of the neck, it is amazing how large an animal it will swallow.

The *Black Snake* of Virginia, which is larger than the above, and generally grows to six feet long, takes a prey proportionable to its size; partridges, chickens, and young ducks. It is generally found in the neighbourhood of the hen-roost, and will devour the eggs, even while the hen is setting upon them; these it swallows whole; and often after it has done the mischief, will coil itself round in the nest.

The whole of this tribe are oviparous, laying eighty or a hundred eggs at a time, in dung-hills, or hot-beds, the heat of which, aided by that of the sun, brings them to maturity. During winter they lie torpid, in banks of hedges, and under old trees.

The *Blindworm* is another harmless reptile, with a formidable appearance. The common length of this species is eleven inches. The
eyes

eyes are red, the head small, the neck still more slender; from that part the body encreases suddenly, and continues of an equal bulk to the tail, which ends quite blunt. The colour of the back is cinereous, marked with very small lines, composed of minute black specks. The motion of this serpent is slow; from which, and from the smallness of the eyes, are derived its names; some calling it the *slow*, and some the *blindworm*. Like all the rest of the kind, in our climates, they lie torpid during winter, and are sometimes found, in vast numbers, twisted together. This animal, like the former, is perfectly innocent; but, like the viper, it brings forth its young alive.

The *Amphisbæna*, or *Double-headed Serpent*, is remarkable for moving along with either the head or the tail foremost, whence it has been thought to have two heads; an error which the slightest inspection detects. It is of equal thickness at both ends; the colour of the skin is like that of the earth; it is rough, hard, and spotted. Some have affirmed that its bite is dangerous, but this must be a mistake, as it wants the fangs, and consequently the elaboratory that prepares the poison.

The *Esculapian Serpent* of Italy is so harmless that, in that country, it is suffered to crawl about the chambers, and often gets into the beds where people lie. It is a yellow serpent, of about an ell long, and, though innocent, yet will bite when exasperated. They are said to be great destroyers of mice, and this may be the reason why they are taken under human protection.

The *Boyuna* of Ceylon is equally a favourite among the natives of that place; it is full as inoffensive, and they consider the meeting of it as a sign of good luck.

The *Surinam Serpent*, which some have improperly called the *Ammoydes* is in like manner harmless and desirable among the natives of that part of the world. They consider themselves as extremely happy if this animal come into their huts. The colours of this serpent are so many and so beautiful, that they surpass all description; and these, perhaps, are the chief inducements to the savages to consider its visits as so very fortunate.

A still greater favourite is the *Prince of Serpents*, a native of Japan, which has not its equal for beauty. The scales which cover the back are reddish, finely shaded, and marbled with large

large spots of irregular figures mixed throughout with black.

The fore part of the head is covered with large, beautiful scales; the jaws bordered with yellow; the forehead marked with a black marbled streak, and the eyes handsome and lively.

But the *Gerenda* of the East Indies is the most honoured and esteemed. To this animal, which is finely spotted with various colours, the natives of Calicut pay divine honours; and while their deity lies coiled up, which is its most usual posture, the people fall upon their faces before it with serious adoration.

The *African Gerenda* nearly resembles the foregoing, being only somewhat larger, and it is worshipped in the same manner by the inhabitants of the coasts of Mosambique.

Such, however, are nearly the whole of this race of animals which may be considered as inoffensive; for when we turn to the larger tribe, even of this species, we find there is nothing but danger to be apprehended. Besides which, this formidable class have something frightful in their colour, as well as their size and form. They want that vivid hue, with which the savages are so much pleased in the lesser kinds. They are all found of a dusky colour, with
large

large teeth, but which are more formidable than dangerous.

As the largest, so, of course, stands foremost in this class, the great *Jiboya* of Java and Brazil, which Leguat affirms he has seen fifty feet long. The largest animal of this kind which has been brought into Europe is but thirty-six feet long; though it is propable that much larger have been seen, and destroyed, before they were thought worth sending so far to satisfy European curiosity. The most usual length, according to all travellers, is about twenty feet, and the thickness in proportion. The teeth are small compared to the size of the body; nor are they used but when it seizes the smallest prey. It lies in wait in the paths frequented by wild animals, and having cast itself upon its prey, wraps so closely round the body as to break all the bones, and then takes the whole at once into its enormous mouth.

The *Boicuagu* is supposed to be the next in magnitude, and has often been seen to swallow a goat whole. It is thickest in the middle of the body, and grows smaller towards the head and the tail. On the middle of the back there is a chain of small black spots, and on each side there are large round black spots, at some distance

tance from each other, with white specks in the centre; between these, near the belly, are two rows of small black spots, which run parallel to the back. It has a double row of sharp teeth in each jaw, shining like mother-of-pearl. The head is broad, and over the eyes it is raised into two prominences: near the extremity of the tail there are two claws, resembling those of birds.

These serpents lie hidden in thickets, whence they sally out unawares, and raising themselves upright on their tails, will attack both men and beasts. They make a loud hissing noise when exasperated; sometimes they wind themselves round trees, where they patiently wait for their prey; on the approach of a beast, or even a traveller, they dart down, and twist so closely round their bodies as to dispatch them in a few minutes.

To this class of large serpents we may refer the *Depona*, a native of Mexico, with a very large head, and great jaws. The mouth is armed with cutting, crooked teeth, among which there are two longer than the rest, placed in the fore part of the upper jaw, but very different from the fangs of the viper. All round the mouth there is a broad, scaly border, and the eyes are

so large that they give it a very terrible aspect. The forehead is covered with very large scales, and on which are placed others that are smaller, curiously arranged: those on the back are of a greyish colour. Each side of the belly is marbled with large square spots, of a chesnut colour, in the middle of which is a small round yellow spot. They avoid the sight of man, and, consequently, never do much harm.

To these which we have enumerated might, possibly, be added many other tribes of serpents; and, indeed, to those naturalists who are inclined to consider every difference in marks and colour as a distinct species, their varieties must be innumerable; but that such would be a false conclusion is clearly demonstrated by the fact, that the brood of one serpent are frequently of seven or eight different colours.

OF INSECTS.

BY some natural historians, this class of animals is considered as the most imperfect of any, while others prefer them to the larger animals. One mark of their imperfection is said to be, that many of them can live a long time, though deprived of those organs which are necessary to life in the higher ranks of nature. Many of them are furnished with lungs and a heart like the nobler animals; yet the caterpillar continues to live, though its heart and lungs, which is often the case, be entirely eaten away. It is not, however, from their conformation alone, that insects are inferior to other animals, but from their instincts also. It is true that the ant and the bee present us with striking instances of assiduity; yet even these are inferior to the marks of sagacity displayed by the larger animals. A bee taken from the swarm is totally helpless and inactive,

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incapable of giving the smallest variations to its instincts. It has but one single method of operating; and if put from that, it can turn to no other; in the pursuits of the hound there is something like choice; but in the labours of the bee, the whole appears like necessity and compulsion. All other animals are capable of some degree of education; their instinct may be suppressed or altered; the dog may be taught to fetch and carry, the bird to whistle a tune, and the serpent to dance: but the insect has only one invariable method of operating; no art can turn it from its instincts; and, indeed, its life is too short for instruction, as a single season often terminates its existence. Their amazing number is also an imperfection. It is a rule which obtains through all Nature that the nobler animals are slowly produced, and that Nature acts with them in a kind of dignified economy; but that the meaner births are lavished in profusion, and thousands are produced merely to supply the necessities of the more favourite part of the creation. Of all productions in nature, insects are by far the most numerous. The vegetables which cover the face of the earth bear no proportion to the multitude of insects; and though, at first sight the

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the herbs of the field seem to be the parts of organized Nature which are produced in the greatest abundance, yet, upon more minute inspection, we shall find that every plant supports a multitude of scarcely perceptible creatures, that fill up the compass of youth, vigour, and age, in the space of a few days existence. In Lapland, and some parts of America, the insects are so numerous, that if a candle be lighted, they swarm about it in such multitudes, that it is instantly extinguished by them ; and in those parts of the world, the miserable inhabitants are forced to smear their bodies and faces with tar, or some other unctious composition, to protect them from the stings of their minute enemies.

On the other hand, Swammerdam argues for the perfection of insects in the following manner : “ After an attentive examination, says he, of the nature and anatomy of the smallest as well as the largest animals, I cannot help allowing to the least an equal, or perhaps a superior degree of dignity. If, while we dissect with care the larger animals, we are filled with wonder at the elegant disposition of their parts, to what a height is our astonishment raised, when we discover all these parts arranged in the least, in the same regular manner? Not

withstanding the smallest of ants, nothing hinders our preferring them to the largest animals, if we consider either their unwearied diligence, their wonderful strength, or their inimitable propensity to labour. Their amazing love to their young is still more unparalleled among the larger classes; they not only daily carry them to such places as may afford them food, but if by accident they are killed, and even cut into pieces, they will, with the utmost tenderness, carry them away piecemeal in their arms. Who can shew such an example among the larger animals, that are dignified with the title of perfect? Who can find an instance in any other creature, that can come in competition with this?"

On this dispute it is only necessary to observe, that the wisdom of the Creator is so conspicuous in all his works, and such surprising art is discovered in the mechanism of the body of every creature, that it is very difficult, if not impossible, to say where it is most, and where it is least, to be observed.

Whoever is desirous of attaining a systematic knowledge of insects, must in the first place acquire the terms made use of in the science, that so he may be able
rightly

rightly to denominate every part of an insect. The student is first to ascertain what an insect is, lest he mistake hippocampi, and other amphibious animals, for them, as was formerly done; or confound them with the *vermes* which Linnæus first distinguished from insects, and which differ as essentially from them, as the class *mammalia* do from birds. Every insect is furnished with a head, antennæ, and feet, of all which the *vermes* are destitute. All insects have six or more feet; they respire through pores placed on the sides of their bodies, and which are termed *spiracula*; their skin is extremely hard, and serves them instead of bones, of which they have internally none. From this definition, the *acus marina* is evidently no insect. But the antennæ placed on the fore part of the head, constitute the principal distinction; these are jointed and moveable in every part, in which they differ from the horns of other animals; they are organs conveying some kind of sense; but we have no more idea of what this kind of sense is, than a man has, who, without eyes, attempts to determine the particular action of the rays of light on the retina of the eye, or to explain the changes which thence take place in the human mind. That
they

they are the organs of some kind of sense, is apparent from their perpetually moving them forward; yet the hard crust with which they are invested, and their shortness in flies and other insects, would lead us to believe that they are not the organs of touch: Mr. Barbut supposes them to constitute or contain the organs of hearing. That they are tubular, and filled with air, and some kind of humour, appears from the antennæ of butterflies immersed in water.

OF THE EXTERNAL PARTS OF THE BODY.



1. The Head. This part, in insects, is without any brain. The difference between the brain and the spinal marrow consists in the former being a medullary part organized. We do not deny the existence of a medullary thread in the heads of insects, but we never could discover it to be organized: hence the *hippobosca equina*, or horse-fly, will live, run, nay, even copulate, after being deprived of its head; to say nothing of many others, which
are

are capable of living a long while in the same situation. As they are not apparently furnished with ears, they have been deemed incapable of hearing; for we can no more conceive that sense to exist without ears, than vision without eyes. That they are nevertheless susceptible of any shrill or loud noise, as well as fish, is indisputable; but it has been supposed to be in a manner different from that of hearing.

Mr. Barbut, however, imagines them to possess this sense in a very distinct manner. Many insects, he observes, are well known to be endowed with the power of uttering sounds, such as large beetles, the bee, wasp, common fly, gnat, &c: the *sphinx atropos* squeaks, when hurt, nearly as loud as a mouse. Now, if insects be endowed with the power of uttering sounds, it certainly must be for some purpose. As they vary their cry occasionally, it must certainly be designed either to give notice of pleasure or pain, or some affection in the creature who possesses it. The knowledge of their sounds, says that author, is undoubtedly confined to their tribe, and is a language intelligible to them only; except when violence obliges the animal to exert the voice of nature in distress, craving compassion; then all ani-

mals understand the doleful cry. For instance, attack a bee, or wasp, near the hive, or nest, or a few of them; the consequence of that assault will be, the animal, or animals, by a different tone of voice, will express his or their disapprobation or pain.

That sound is known to the hive to be plaintive, and that their brother, or brethren, require their assistance; and the offending party seldom escape with impunity. Now if they had not the sense of hearing, they could not have known the danger their brother, or brethren, were in by the alteration of their tone.

Another proof, which he reckons still more decisive, was taken from an observation made by himself on a large spider in St. James's Park. This creature had made a very large web on a wooden railing, and was, at the time of observation, on one of the rails at a considerable distance from the place where a large fly entangled itself. Yet, the moment the fly was entangled, the spider became sensible of it; though from the situation of the rail, he could not possibly have seen it. In this, however, Mr. Barbut might possibly be deceived; the spider was, perhaps, alarmed by the tremulous motion of the threads, occasioned by the
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the fluttering of the fly; which he might easily know how to distinguish from their vibration by the wind. The organ of hearing, in our author's opinion, is situated in the antennæ; both from their position in the part of the head most favourable to such organs, and their inward structure being moveable, the ears of most inferior animals being so. He has never considered the antennæ as being either offensive, or defensive, but has observed them to be endowed with an exquisite sense of feeling; that the animal appeared to be in agony when its antennæ were pinched; and that it takes care to avoid the touching any hard substance with them roughly. "This tenderness in the organ of hearing, says he, is common to all animals; and insects seem to be particularly tender in these parts, by quickly withdrawing them from the touch." That author further observes that the antennæ of all insects are composed of joints varying in size, form, and number. Those who are destined to live chiefly under water, have their antennæ shorter than those who live on land. Some who roam at large in the air, have them long and slender. They are all hollow, and are rendered flexible by the joints. This hollowness, in our author's opinion, is to receive the

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sound communicated to the extremities of the antennæ by the repercussion of the air affected by any noise, and convey it, by means of the joints, from one to another, till it arrives in that lessened degree of tone best suited to the timid nature of the animal. In this circumstance there may be many variations in point of perfection in those organs; the strength, utility, and degree of power in receiving sound, being proportioned to the necessities of the animals, different in their nature and requisites. In most animals the entrance to the auricular organ is patulous; but in this case the animal would suffer great inconvenience from such an organization, as the organ would often be clogged with dirt, &c.

It has also appeared dubious whether they have the sense of smell, no organ being found in them which seems to be adapted to that purpose: and although it was evident they had a preception of agreeable and foetid effluvia, it was thought to be in a manner altogether unknown to us. Mr. Barbut is of opinion however that the organs of smell reside in the palpi, or feelers. Many insects have four, and some six; two of which are in general chalciform, in order to assist the insect in conveying its food to its mouth.

It

It may be likewise observed, that the palpi are in continual motion; the animal thrusting them into every kind of putrid or other matter, as a hog would do his nose, smelling and searching after food. Insects, which apparently do not possess palpi, or spiral tongues, have undoubtedly some organ concealed within the mouth analogous to them in function and utility; the fleshy proboscis of the fly is thrust into every substance in which the animal expects to find food; and when it is extended, nearly in the middle, are situated, in our author's opinion, two upright palpi, which, no doubt, perform in their turn some office, perhaps that of smell.

Many insects have no tongue, nor make any sound with their mouth; but, for this purpose, some use their feet, others their wings, and others some elastic instrument with which they are naturally furnished.

Eyes. Most insects have two; but the gyrenus has four; the scorpion six; the spider eight; and the scolopendra three; they have no eye-brows, but the external tunic of their eyes is hard and transparent like a watch-glass; their eyes have no external motion. They

chiefly consist of one lens only; but in those of the butterfly, and many of the beetles, they are more numerous. Pugett discovered 17,325 lenses in the cornea of a butterfly, and Leuwenhoek, 800 in a fly.

Antennæ. Of these there are in general two, which are placed on the fore-part of the head; they are peculiar to insects, and are plainly distinguishable from the palpi, which are more numerous, commonly four, sometimes six; they are placed near the mouth, and are sometimes wanting.

The mouth of most insects is placed in the anterior part of the head, extending somewhat downward, while in others it is placed under the breast, as in the chermes, &c. Many have a proboscis which is the mouth drawn out to a rigid point; in several of the hemiptera class it is bent downward towards the breast and belly, as in the bug, &c. They have in general two jaws; some of them, indeed, have four, and others even more; they are placed horizontally; the inner edge of them, in some, is serrated, or furnished with little teeth. The tongue, as in the butterfly, is taper and spiral, but in others it is fleshy, resembling a proboscis, and tubular, as in the fly.

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The greatest part of insects have the number of their legs confined to six; mites, spiders, and scorpions, however, have eight; the oniscus has fourteen; and there are some few which have still more. The first joint of the leg is generally thickest, and is called *femur*; the second, which is of the same size throughout, *tibia*; the third, which is jointed, *tarsus*; and the last, which in most insects is double, *unguis*. The claws are the fore-feet enlarged towards their extremities, each of which is furnished with two lesser claws, which act like a thumb and finger.

Their wings are membraneous and undivided, except in the instance of the *phalæna alucita*, in which they are in part divided. Most insects have four; but the diptera-class and the coccus have only two. The wing is divided into its inferior and superior surfaces; its anterior part in a butterfly, is that towards the anterior margin, or next to the head; its posterior part that towards the anus; its exterior part that towards the outer edge; and the inferior that next the abdomen.

The tails of insects, with very few exceptions, are simple, capable of being extended and drawn back at pleasure.

OF THE SEXES.

THE same difference of sex exists in insects as in other animals, and they even appear more disposed to increase their species than other animals; many of them, when become perfect, seeming to be created for no other purpose but to propagate their species. Thus the silk-worm, when it arrives at its perfect, or moth state, is incapable of eating, and can hardly fly: it endeavours only to propagate its species; after which, the male immediately dies, and the female also, as soon as she has deposited her eggs.

In many insects, the male and female are with difficulty distinguished; while in some they differ so widely, that an unskilful person might easily take the male and female of the same insect for different species; as in the *phalæna*, *humuli*, *pinaria*, and *russula*, each sex of which differs in colour.

This

This dissimilarity is still more apparent in some insects, as the coccus, &c. in which the male has wings, and the female none. And as some insects remain a long while in copulation, as we may see in the tipula and silk-worm, the winged males fly with the wingless females, and carry them about from one place to another. It is, however, no certain rule, that when one insect of the same species is found to have wings, and the other to be without, that the former must necessarily be the male, and the other the female. The *aphides*, for instance, are an exception; and besides these, individuals of both sexes, and of the same species, are found without wings, as the carabi, &c.

The *gryllus pedestris* is likewise destitute of wings; and might have passed for a gryllus in its pupa state, had it not been seen in copulation; for it is well known that no insect can propagate its species, till it arrives at its last or perfect state.

Besides those of the male and female, a third sex exists in some insects, which we call *neuter*; and as these have not the distinguishing parts of either sex, they may be considered as eunuchs, or infertile.

We

We know of no instance of this kind in any other class of animals, nor even in vegetables, except in class syngenesiæ, and in the opulus. This kind of sex is only found among those insects which form themselves into societies, such as bees, wasps, and ants: and here these kind of eunuchs are real slaves, as on them lies the whole business of the economy; while those of the other sex are idle, or only employing themselves in the increase of the family. Each family of bees has one female only (called the Queen), many males, and almost an innumerable quantity of neuters. Of these, the neuters (whose antennæ have eleven joints) do the working part; they extract and collect honey and wax, build up the cells, keep watch, and do a variety of other things.

The males, whose antennæ consist of fifteen joints, do no work; they serve the female once, and that at the expence of their lives; they may be considered in the light of a set of parasites, or cecisbeos; but as soon as their business of impregnation is over, they are expelled by their servants, the neuters, who now shake off the yoke, but yet pay all due respect to their common mother the queen. Nearly the same economy takes place in wasps, where the
young

young females, which are impregnated in the autumn, live through the winter, and in the spring, propagate their species; but the queen, together with all the males perish in the winter. Among ants the neuters form a hill in the shape of a cone, that the water may run off it, and place those which are in the pupa state on that side of it which is the least exposed to the heat of the sun. At a considerable distance from these are found the habitations of the males and females, to whom the most ready obedience is paid by the neuters, till a new offspring succeeds, and then they oblige them to quit their habitations. But those ants which live entirely under ground, provide better for themselves in this respect: for, a little before their nuptials, they quit the habitation of their own accord, and after swarming in the manner of bees, they copulate in the air; and each retiring to some new habitation, founds a new family.

No hermaphrodites have as yet been discovered among insects; but there is something very singular, in the propagation of the aphides. A female aphis, once impregnated, can produce young, which will continue to produce others without any fresh impregnation,

even to the fifth progeny; afterwards a fresh impregnation must take place.

The male insects, like male hawks, are always smaller than the females; in the propagation of their species, they are remarkably careful; so that it is with the greatest difficulty that flies are kept from depositing their eggs on fresh meat; the cabbage butterfly from laying them on cabbage, and other insects from depositing them in the several places peculiar to each. The scarabæus, pilularious, and carnifex, are deserving our attention, as they afford a mutual assistance to each other; for when the female has laid her eggs in a little ball of dung, the males with their feet, which are axiform, assist the females to roll it to some suitable place; as Aristotle and Pliny formerly, and Loeffling has lately observed.

It is very wonderful to observe, that in the coccus and oniscus. the female has no sooner brought forth her young, than she is devoured by it; and that the sphex should be able so readily to kill the caterpillar of a moth, then bury it in the earth, and there deposit her eggs in it. Nor can we without admiration behold the same species of aphid which was viviparous in the summer, become oviparous in the autumn.

Almost

Alinost innumerable examples might be brought of the singularities in the eggs of insects: we shall, however, only mention those of the hemerobius, which are deposited on a foot-stalk, those of the phalæna neustri, which are placed regularly in a ring round the branch of some tree; and the compound eggs of the blatta.

METAMORPHOSES OF INSECT

THERE are no insects, except of the optera class, but what are continually undergoing some tranformation. Insects change first from the egg, into the caterpillar or maggot; then into the pupa chrysalis, and lastly, into the fly, or perfect state. During each of those changes, their appearance differ as much as night and day.

The insect, as soon as it comes out of the egg, was, by former entomologists called *eruca*; but as this is synonymous with the botanic name *sisymbrium*, it was changed by Linnæus for the term *larva*; a name expressive of the insect's being, in this state, as it were masked, having its true appearance concealed. Under

this mask, or skin, the entire insect, such as it afterwards appears when perfect, lies concealed, enveloped only in its tender wings, and putting on a soft and pulpy appearance; inso-much that Swammerdam was able to demonstrate a butterfly, with its wings, to exist in a caterpillar, though it bore but a faint resemblance to its future perfection. The insect, therefore, in this state, undergoes no other alteration but the change of its skin; the *larvæ* are, for the most part, larger than the insect, when perfect, and are very voracious; the caterpillar of the cabbage butterfly eats double what it would seem to require from its size; but its growth is not adequate to its voracity.

Pupa: the insect in this state, was formerly called *chrysalis*, or *aurelia*, but as the appearance of gilding is confined to a few butterflies only, the term of *pupa* has been adopted in its stead; because the lepidoptera especially resembles an infant in swaddling clothes; and in this state all, except those of the hemiptera class, take no nourishment.

Tonago is the third state. This name is given by Linnæus to this third change, in which the insect appears in its proper shape and colours; and as it undergoes no more trans-

transformations, it is called perfect. In this state it flies, is capable of propagating its species, and receives true antennæ; which before, in most insects, were scarcely apparent.

AS insects are endowed with the various powers of creeping, flying, and swimming; there is scarcely any place, however remote and secure, in which they are not to be found; and therefore, upon casting a slight view over the whole insect tribe, just when they are supposed to rouse from their state of annual torpidity, when they begin to feel the genial influence of spring, and again exhibit new life in every part of nature, their numbers and their varieties seem to exceed all powers of calculation, and they are certainly too great for description; but from the similtudes of the form, manners, and propagation of several of them, the extensive discription has been easily compressed, and a separate history of each species has become totally unnecessary. Swammerdam, Rheaurmur,

Rheumur, and Linnæus, undertook the task of abridging their descriptions; and Goldsmith, availing himself of their joint labours, has, with much propriety divided the whole class of insects into four separate distributions. His arrangement we shall principally follow, as under it may be contained a sufficiently comprehensive detail of the whole class of insects, which he has faithfully described to consist of “ little
“ animals without red blood, bones, or cartilages, furnished with a trunk, or else a mouth
“ opening lengthwise, with eyes which they are
“ incapable of covering, and with lungs which
“ have their opening on the sides. This definition comprehends the whole class of insects, whether with or without wings, whether in their caterpillar or butterfly state, whether produced in the ordinary method of generation between male and female, or from an animal that is itself both male and female, or from the same animal cut into several parts, and each part producing a perfect animal.”

The *first* animals that offer themselves are those that want wings, which appear crawling about on every plant, and on every spot of earth which we regard with any degree of attention.

tion. Those, therefore, that never have wings, but creep about till they die, may be considered as constituting the first class of insects. All these, the flea and the wood-louse only excepted, are produced from an egg; and, when once they break the shell, they never suffer any further change of form, but continue to grow larger till they die. The *second* order of insects consists of such as have wings; but which, when produced from the egg, have those wings cased up in such a manner as not to appear. The *third* order of insects is of the moth and butterfly kind. All these have four wings, each covered with a mealy substance of various colours, which when handled, comes off upon the fingers; and, if examined by the microscope, will appear like scales, with which the wing is nicely embroidered over. The *fourth* order is of those winged insects which come from a worm, instead of a caterpillar, and yet go through changes similar to those which moths and butterflies are seen to undergo. To these we add, as a *fifth* order, a numerous tribe lately discovered, to which naturalists have given the name of Zoophytes. These do not go through the ordinary forms of generation, but may be propagated by dissection. They seem a set of

9 creatures

creatures placed between animals and vegetables, and make the shade that connects sensible and insensible nature.

OF INSECTS WITHOUT WINGS.

THIS tribe may be said to consist of all such as resemble the flea, the louse, the spider, the bee, the wood-louse, and the water-louse; all of which are produced from an egg in that form from which they never change, nor ever acquire wings.

If we consider this class as distinct from others, we shall find them, in general longer lived than the rest, and often continuing their term beyond one season, which is the ordinary period of an insect's existence. They seem also less subject to the influence of the weather; and often endure the rigours of winter without being numbed into torpidity. The whole race of moths, butterflies, bees, and flies, are rendered

dered lifeless by the return of cold weather; but we need not be told, that the louse, the flea, and many of those wingless creatures that seem formed to teize mankind, continue their painful depredations the whole year round.

They come to perfection in the egg, and it sometimes happens, that when the animal is interrupted in performing the offices of exclusion, the young ones burst the shell within the parent's body, and are thus brought forth alive. This not unfrequently happens with the wood-louse, and others of the kind, which are sometimes seen producing eggs, and sometimes young ones perfectly formed.

Though these creatures are perfect from the beginning, yet they are often, during their existence, seen to change their skin: this is a faculty which they possess in common with many of the higher ranks of animals, and which answers the same purposes. However tender their skins may seem to us, yet if compared to the animal's strength and size, they will be found to resemble a coat of mail, or, to speak more intelligibly, the shell of a lobster. By this skin these animals are defended from accidental injuries, and particularly from the attacks of each other; within this they continue to grow, till

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their bodies become so large as to be imprisoned in their own covering, when the shell bursts, and is quickly replaced by a new one.

Lastly, these animals are endued with a degree of strength for their size, that at first might exceed credibility. Had man an equal degree of strength, bulk for bulk, with a louse or flea, the history of Samson would be no longer miraculous. A flea will draw a chain a hundred times heavier than itself; and to compensate for this force, will eat ten times its own size of provision in a single day.

The *Spider* is the animal that deserves our first notice in this principal order of insects, whose manners are the most subtle, and whose instincts the most various. Formed for a life of rapacity, and incapable of living upon any other than insect food, all its habits are calculated to deceive and surprize; it spreads toils to entangle its prey; it is endued with patience to expect its coming; and is possessed of arms and strength to destroy it when fallen into the snare.

In these countries, where all the insect tribes are kept under by human assiduity, the spiders are but small and harmless. We are acquainted with few except the *house-spider*, which weaves its

its web in neglected rooms; the *garden-spider*, that spreads its toils from tree to tree; and rests in the centre; the *wandering spider*, that has no abode like the rest; and the *field-spider*, which is sometimes seen mounting, web and all, into the clouds. These are the chief of our native spiders; and which, though reputed to be venomous, are entirely inoffensive. But they form a much more terrible tribe in Africa and America; and it is a well known fact, that the bottom of the *Martinico spider's* body is as large as a hen's egg, and covered all over with hair. Its web is strong, and its bite dangerous.

Every spider has two divisions in its body. The fore part, containing the head and breast, is separated from the hinder part or belly by a very slender thread, through which, however, there is a communication from one part to the other. The fore part is covered with a hard shell, as well as the legs, which adhere to the breast. The hinder part is clothed with a supple skin, beset all over with hair. They have several brilliant and acute eyes all round the head; they are sometimes eight in number, sometimes but six; two behind, two before, and the rest on each side. Like all other insects, their eyes are immoveable; and they

want eye-lids ; but this organ is fortified with a transparent horny-substance, which at once secures and assists their vision. As the animal procures its subsistence by the most watchful attention, so large a number of eyes was necessary to give it the earliest information of the capture of its prey. They have two pincers on the fore part of the head, rough, with strong points, toothed like a saw, and terminating in claws like those of a cat. A little below the point of the claw there is a small hole, through which the animal emits a poison, which, though harmless to us, is sufficiently capable of instantly destroying its prey. This is the most powerful weapon they have against their enemies ; they can open or extend these pincers as occasion may require ; and when they are undisturbed, they suffer them to lie one upon the other, never opening them but when there is a necessity for their exertion. All of them have eight legs, jointed like those of lobsters, and similar also in another respect ; for if a leg be torn away, or a joint cut off, a new one will quickly grow in its place, and the animal will find itself fitted for combat as before. At the end of each leg there are three crooked moveable claws ; namely, a small one, placed higher up,

up, like a cock's spur, by the assistance of which it adheres to the threads of its web. There are two others larger, which meet together like a lobster's claw, by which they can catch hold of the smallest depressions, walking up or down the most polished surfaces, on which they can find inequalities that are imperceptible to our grosser sight. But when they walk upon such bodies as are perfectly smooth, as looking-glass, or polished marble, they squeeze a little sponge which grows near the extremity of their claws, and thus diffusing a glutinous substance, adhere to the surface until they make a second step. Besides the eight legs just mentioned, these animals have two others, which may more properly be called arms, as they do not serve to assist motion, but are used in holding and managing their prey.

The spider, though thus formidably equipped, would seldom prove successful in the capture, were it not equally furnished with other instruments to assist its depredations. It is a most experienced hunter, and spreads its nets to catch such animals as it is unable to pursue. The spider's web is generally laid in those places where flies are most apt to come and shelter; and there this little animal remains for days,

days, nay weeks together, in patient expectation, seldom changing its situation though ever so unsuccessful.

For the purposes of making this web, Nature has supplied this animal with a large quantity of glutinous matter within his body, and five dugs or teats for spinning it into thread. This substance is contained in a little bag, and at first sight resembles soft glue; but when examined more accurately, it will be found to be twisted into many coils of an agate colour, and upon breaking it, the contents may be easily drawn out into threads, from the tenacity of the substance, not from those threads being already formed. Those who have seen the machine by which wire is spun, will have an idea of the manner in which this animal forms the threads of its little net, the orifices of the five teats above mentioned, through which the thread is drawn, contracting or dilating at pleasure. The threads which we see, and which appear so fine, are, notwithstanding, composed of five joined together, and these are many times doubled when the web is in formation.

When a house-spider proposes to begin a web, it first makes choice of some commodious spot, where there is an appearance of plunder
and

and security. The animal then distils one little drop of this glutinous liquor, which is very tenacious, and then creeping up the wall, and joining its threads as it proceeds, it darts itself in a surprising manner, to the opposite place, where the other end of the web is to be fastened. The first thread thus formed, drawn tight, and fixed at each end, the spider then runs upon it backward and forward, still assiduously employed in doubling and strengthening it, as upon its force depends the strength and stability of the whole. The scaffolding thus compleated, the spider makes a number of threads parallel to the first in the same manner, and then crosses them with others; the clammy substance of which they are formed, serving to bind them, when newly made, to each other. The insect, after this operation, doubles and trebles the thread that borders its web, by opening all its teats at once, and secures the edges, so as to prevent the wind from blowing the work away. The edges being thus fortified, the retreat is next to be attended to; and this is formed like a funnel at the bottom of the web, where the little creature lies concealed. To this are two passages, or outlets, one above and the other below, very artfully contrived, to give it an opportunity

opportunity of making excursions, at proper seasons, of prying into every corner, and cleaning those parts which are observed to be clogged or encumbered. Still attentive to its web, the spider, from time to time, cleans away the dust that gathers round it, which might otherwise clog and incommode it : for this purpose, it gives the whole a shake with its paws ; still, however, proportioning the blow so as not to endanger the fabric. It often happens also, that from the main web there are several threads extended at some distance on every side : these are, in some measure, the outworks of the fortification, which, whenever touched from without, the spider prepares for attack or self-defence. If the insect, which is entangled in the web, be a fly, it springs forward with great agility ; if, on the contrary, it be the assault of an enemy stronger than itself, it keeps within its fortress, and never ventures out till the danger be over. Another advantage which the spider reaps from this contrivance of a cell, or retreat behind the web, is that it serves for a place where the creature can feast upon its game with all safety, and conceal the fragments of those carcasses which it has picked, without exposing to public view the least trace of barbarity,

barity, that might create a suspicion in any insects that their enemy was near.

It often happens, however, that the wind, or the shaking of the supporters, or the approach of some large animal, destroys, in a minute, the labours of an age. In this case the spider is obliged to remain a patient spectator of the universal ruin; and when the danger is passed away, it sets about repairing the calamity, being possessed of a large quantity of the glutinous substance of which the web is made. It sometimes undertakes the task of forming a new web; but, in general, the animal is much fonder of mending than making, as it is furnished originally with but a certain quantity of glutinous matter, which, when exhausted, nothing can renew. The time seldom fails to come, when their reservoirs are entirely dried up, and the poor animal is left to all the chances of irretrievable necessity. An old spider is thus frequently reduced to the greatest extremity; its web is destroyed, and it wants the materials to make a new one. But as it has been long accustomed to a life of shifting, it hunts about to find out the web of another spider, younger and weaker than itself, with whom it ventures a battle. The invader generally

succeeds; the young one is driven out to make a new web, and the old one remains in quiet possession. If, however, the spider is unable to dispossess any other of its web, it then endeavours, for a while, to subsist upon accidental depredation; but in two or three months it inevitably dies of hunger.

The *Garden-spider* seems to work in a different manner. The method which this insect adopts is to spin a great quantity of thread, which floating in the air in various directions, happens from its glutinous quality, at last to stick to some object near it, a lofty plant, or the branch of a tree. The spider only wants to have one end of the line fast, in order to secure and tighten the other. It accordingly draws the line when thus fixed, and then by passing and repassing upon it, strengthens the thread in such a manner as to answer all its intentions. The first cord being thus stretched, the spider walks along a part of it, and there fastens another, and dropping thence, fastens the thread to some solid body below, then climbs up again and begins a third, which it fastens by the same contrivance. When three threads are thus fixed, it forms a square, or something that very nearly resembles one; and in this the animal is generally

generally seen to reside. It often happens, however, when the young spider begins spinning, that its web becomes too buoyant, and not only the thread floats in the air, but even the little spinster. In this manner we have often seen the threads of spiders floating in the air; and what is still more surprising, the young spiders themselves attached to their own web.

The web being thus completed, and fixed in a proper place, its next care is to seize and secure whatever insect happens to be caught in the toil. For this purpose, it remains for weeks, and even months, upon the watch, without catching a single fly; for the spider, like most other insects, is surprisingly patient of hunger. It sometimes happens that too strong a fly strikes itself against the web, and thus, instead of being caught, tears the net to pieces. In general, however, the butterfly or the hornet, when they touch the web, fly off again, and the spider seems little inclined to interrupt their retreat. The large blue-bottle-fly, the ichneumon-fly, and the common meat-fly, seem to be its favourite game. When one of these strike into the toils, the spider is instantly seen alert and watchful at the mouth of its hole, careful to observe whether the fly be com-

pletely secured. If that be the case, he walks leisurely forward, seizes its prey, and instantly kills it by instilling a venomous juice into the wound which it makes. If, however, the fly be not fast, the spider patiently waits, without appearing till its prey has fatigued itself by its struggles to obtain its liberty; for should the ravager appear in all his terrors while the prey is but half involved, a desperate effort might give it force enough to get free. If the spider have fasted for a long time, it then drags the fly immediately into its hole and devours it; but if there have been plenty of game, and the animal be no way pressed by hunger, it then gives the fly two or three turns in its web, so as to completely secure it, and there leaves it impotently to struggle until the little tyrant comes to his appetite.

It has been the opinion of some philosophers, that the spider was in itself both male and female; but Lister has been able to distinguish the sexes, and to perceive that the males were much less in size than the females. As most of these insects prey upon each other, except during the time of their amours, they dare not come within reach of one another but with the utmost caution. They may sometimes be

seen stretching out their legs, shaking the web, and tampering with each other by a slight touch with the extremity of their feet; then in a fright dropping hastily down their thread, and returning in a few moments to make fresh trial by feeling. When both parties are well assured of the sex they have to deal with, the approaches of their feet, in order to feel, become more frequent, confidence takes place, and amorous dalliance ensues. "We cannot," says Lyonnet, "but admire how careful they are, not to give themselves up blindly to a passion, or venture an imprudent step, which might become fatal to them." Lister and Lyonnet, two accurate observers, say, that the extremity of those arms, or claws, which the spider uses to grasp his prey with, suddenly opens, as it were, with a spring, and lets out a white body, which the male applies beneath the abdomen of the female, to fulfil the wish of nature.

The female generally lays from nine hundred to a thousand eggs in a season; they are of a bluish colour speckled with black. These eggs are large or small in proportion to the size of the animal that produces them. In some they are as large as a grain of mustard-seed;
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in others, they are scarcely visible. The female never begins to lay till she is two years old.

When the number of eggs which the spider has brought forth has remained for an hour or two to dry after exclusion, the little animal then prepares to make them a bag, where they are to remain until they leave the shell. For this purpose she spins a web four or five times stronger than that made for catching flies; and, besides, lines it with a down, which she plucks from her own breast. This bag, when completed, is as thick as paper, is smooth within side, but rough without. Within this they deposit their eggs; and it is almost incredible to relate the concern and industry which they bestow in the preservation of it. They stick it, by means of their glutinous fluid, to the end of their body; so that the animal, when thus loaded, appears as if she had one body placed behind another. If this bag be separated from her by any accident, she employs all her assiduity to stick it again in its former situation, and seldom abandons her treasure but with her life. When the young ones are excluded from their shells they remain for some time in their confinement, until the

the female, instinctively knowing their maturity, bites open their prison, and sets them free. But her parental care does not terminate with their exclusion; she receives them upon her back for some time, until they have strength to provide for themselves, when they leave her never to return, and each begins a separate manufactory of its own. The young ones begin to spin when they can scarcely be discerned; and prepare for a life of plunder before they have strength to overcome.

There are some species of spiders remarkable for darting out long threads, and by means of which they can convey themselves to great distances. Dr. Lister tells us, that, attending closely to a spider weaving a net, he observed it suddenly to desist in the mid-work; and turning its tail to the wind, it darted out a thread with the violence and stream which we see water spout out of a jet: this thread, taken up by the wind, was immediately carried to some fathoms long; still issuing out of the belly of the animal. Presently after the spider leaped into the air, and the thread mounted her up swiftly. After this discovery, he made the like observation in nearly thirty different sorts of spiders; and found the air filled with young and old,
sailing

sailing on their threads, and doubtless seizing gnats and other insects in their passage, there being often manifest signs of slaughter, legs and wings of flies, &c. on these threads, as well as in their webs below. Dr. Hulse discovered the same thing about the same time.

Dr. Lister thinks there is a fair hint of the darting of spiders in Aristotle, Hist. An. lib. ix. cap. 39. and in Pliny, lib. x. cap. 74. but with regard to their sailing, the ancients are silent, and he thinks it was first seen by him. He also observes of these sailing spiders, that they will often dart, not a single thread only, but a whole sheaf at once, consisting of many filaments, yet all of one length, all divided each from the other and all distinct until some chance either snap them off, or entangle them. But for the most part you may observe, that the longer they grow, the more they spread and appear, to a diligent observer, like the numerous rays in the tail of a blazing star. As for that which carries them away in the air, it is partly their sudden leap, partly the length and number of the threads projected, the stream of the air and wind beating more forcibly upon them, and partly the posture and management of their feet, which, at least by some sort
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of them, I have observed to have been used very like wings or oars, the several legs being sometimes close joined, at other times opened, again bent, extended, and according to the several necessities and will of the sailor. They cannot be strictly said to fly for they are carried into the air by external force; but they can, in case the wind suffer them, steer their course, and perhaps mount and descend at pleasure: and for the purpose of rowing themselves along the air, it is observable that they always take their flight backwards; that is, their head looking a contrary way, like a sculler upon the Thames. It is scarcely credible to what height they will mount; which yet is precisely true, and a thing easily to be observed by one that shall fix his eye some time on any part of the heavens, the white webs, at a vast distance, very distinctly appearing from the azure sky; but this is in autumn only, and that in very fair and calm weather. In a letter to Mr. Ray, dated January, 1670, speaking of the height spiders are able to fly to, he says, “ Last
“ October I took notice that the air was very
“ full of webs; I forthwith mounted to the
“ top of the highest steeple on the Minster, in
“ York, and could there discern them yet ex-
“ ceeding high above me.”

He further observes, that they not only thus shoot their threads upwards, and mount with them in a line almost perpendicular, they also project them in a line parallel to the horizon, as may be seen by their threads running from one wall to another in a house, or from one tree to another in a field, and even from wall to wall across gardens of considerable extent. The matter of which the spider's threads are formed, we have already observed, is a viscid juice, elaborated in the body of the animal, and emitted from papillæ situated at the extremity of the belly; which papillæ are furnished with numerous apertures that do the business of wire-drawers, as it were, in forming the threads. Of these apertures, M. Rheumur observes, there are enough in the compass of the smallest pin's head, to yield a prodigious quantity of distinct threads. The holes are perceived by their effects: take a large garden-spider ready to lay its eggs, and applying the finger on a part of its papillæ, as you withdraw that finger, it will take with it an amazing number of threads. M. Rheumur has often counted 70 or 80 with a microscope, but has perceived that there were infinitely more than he could tell. In effect, if he should say that each tip of a papillæ furnished
a thousand

a thousand he should say much too little. The part is divided into a number of little prominences, like the eyes of a butterfly, and each prominence no doubt makes its several threads; or rather between the several protuberances there are holes that give vent to threads: the use of the protuberances, in all probability, being to keep the threads at their first exit, before they are yet hardened by the air, asunder: In some spiders these protuberances are not so serviceable, but in lieu of them, there are tufts of hair which may serve the same office, viz. to keep the threads apart; be this as it may, however, threads may issue from above a thousand different places in every papillæ; consequently the spider, having five papillæ, has holes for above five thousand threads.

Such is the tenuity of the threads in the larger sort of spiders; yet if we examine the young produced by those, we shall find that they no sooner quit their egg than they begin to spin; indeed their threads can scarcely be perceived, but the webs may; they are frequently as thick and close as those of house spiders; and no wonder, there being often four or five hundred little spiders concurring to the same work.

How minute must their holes be ! the imagination can scarcely conceive that of their papillæ; the whole spider is perhaps less than a papillæ of the parent which produced it. But there are even some kinds of spiders so small at their birth that they are not visible without a microscope. There are usually found an infinity of these in a cluster, and they only appear like a number of red points ; and yet there are found webs under them, though scarcely perceptible. M. Leuwenhoek has computed that one hundred of the single threads of a full grown spider are not equal to the diameter of the hair of his beard, and consequently that if the threads and hair be both round, ten thousand such threads are not bigger than such a hair. He calculates further, that when young spiders first begin to spin, four hundred of them are not larger than one which is of a full growth ; allowing which, four millions of a young spider's threads are not so big as a single hair of a man's beard.

Garden Spiders, particularly the short legged species, yield a kind of silk, which has by some been judged scarcely inferior to that of the silkworm. Mr. Bon, of Languedoc, about 70 years ago, contrived to manufacture from it a pair of silk stockings and mittens, of a beautiful
natural

natural grey colour, which were almost as handsome and strong as those made with common silk; and he published a dissertation concerning the discovery. But M. Rheaurmur being appointed by the Royal Academy to make a further enquiry into this new silk work, raised several objections and difficulties against it, which are found in the Memoirs of the Academy for the year 1710. The sum of what he has urged amounts to this: that the natural fierceness of the spiders renders them unfit to be bred and kept together. Four or five thousand being distributed into cells, fifty in some, one or two hundred in others, the big ones soon killed and eat the less, so that in a short time there were scarce left more than one or two in a cell; and to this inclination of mutually eating one another, M. Rheaurmur ascribes the scarcity of spiders, considering the vast number of eggs which they lay. But this is not all; he even affirms that the spider's bag is inferior to that of the silkworm, both in lustre and strength, and that it produces less matter to be manufactured. The thread of the spider's web, he says, only bears a weight of two grains without breaking, and that of the bag bears thirty-six. The latter, therefore, in all probability, is eighteen times thicker

thicker than the former; yet it is weaker than that of the silk-worm, which bears a weight of two drachms and a half; so that five threads of the spider's bag must be put together to equal one thread of the silk-worm's bag.

Now it is impossible that these should be applied so justly over one another as not to leave little vacant spaces between them, whence the light will not be reflected, and in consequence a thread thus composed must fall short of the lustre of a solid thread; add to this, that the spider's thread cannot be wound off like that of the silk-worm but must of necessity be carded; by which means, being torn in pieces, its evenness, which contributes much to its lustre, is destroyed. In effect, this want of lustre was taken notice of by M. de la Hire, when the stockings were presented to the Academy. Again, spiders furnish much less silk than the worms; the largest bags of the latter weigh four grains, the smaller three grains; so that 2304 worms produce a pound of silk. The spider bags do not weigh above one grain; yet when cleared of their dust and filth, they lose two-thirds of their weight. The work of twelve spiders, therefore, only equals that of one silk-worm; and a pound of silk will require at

least 27,648 spiders, but as the bags are wholly the work of the females, who spin them to deposit their eggs in, there must be kept, 55,296 spiders to yield a pound of silk. Yet will this only hold of the best spiders; those large ones ordinarily seen in gardens, &c. scarce yielding a twelfth part of the silk of the others. 280 of these he shews would not yield more than one silk-worm; 663,552 of them would scarce yield a pound.

Spiders frequently change their colour, which varies much in respect to season, sex, age, &c. but they are in general more beautifully variegated in autumn; a season not only the most opportune and plentiful respecting their prey, but at the time when they arrive at their greatest magnitude, and are in their height of vigour. The species of spiders enumerated by naturalists amount to upwards of fifty; of which it may here suffice to mention a few of the most remarkable.

1. The *Calycina*, with a round pale yellow belly, and two hollow points; it lives in the cups of flowers after the flower leaves are fallen off, and catches bees, and other flies, when they are in search of honey.

The

2. The *Avicularia* has a convex round breast, hollowed transversely in the middle. It is a native of America, and feeds upon small birds, insects, &c. the bite of this spider is as venomous as that of the serpent.

3. The *Ocellati*, has three pair of eyes on its thighs; it is about the same size with the tarantula, of a pale colour, with a black ring round the belly, and two large black spots on the sides of the breast; it is a native of China.

4. The *Saccata*, has an oval belly, of a dusky iron colour; it lives in the ground, and carries a sack with its eggs wherever it goes. This sack it glues to its belly, and will rather die than leave it behind.

5. The *Diadema*, is the largest spider this country produces; the abdomen is of an oval form, downy, and of a ruddy yellow colour, which is very variable in different seasons, being sometimes paler, at others very dark coloured, the upper part is beautifully adorned with black and white circles and dots, having a longitudinal band in the middle, composed of oblong and oval shaped pearl coloured spots, so arranged as to resemble a fillet, similar to those worn by the

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the Eastern Kings; the ground upon which this fillet, and the white dots are laid, when viewed with a glass, and the sun shining thereon, is beautiful and rich beyond all description. There are varieties in colour of this spider when young; some have their abdomen purple, ornamented with white dots, the legs yellow, and annulated with a deeper colour; others have their abdomen of a fine red, likewise ornamented with white, but the legs of a fine pale green colour, annulated with dark purple, or black. It inhabits the birch trees.

6. The *Cucurbitina* has a globular yellow belly, with a few black spots; it lives in the leaves of trees, and incloses its eggs in a soft net.

7. The *Labyrinthica*, with a dusky oval belly, a whitish indented line, and a forked anus. The web of this species is horizontal, with a cylindrical well or tube in the middle.

8. The *Fimbriata* has a black oblong belly, with a white line on each side, and dusky coloured legs; it lives in water, upon the surface of which it runs with great swiftness.

9. The *Holosericea* has an oval belly, covered with a down like velvet; at the base or

under part it has two yellow spots. It is found in the folded leaves of plants.

10. The *Viatica*, or Wanderer, is generally of a yellow colour, more or less deep, sometimes it is whitish, and even rather green; the abdomen is large, broad, almost square, with two bands of dark orange, which arising from the thorax descends obliquely on the sides towards the middle. Between the bands are a few small black dots forming a kind of triangle upon the middle of the abdomen; on the thorax are seen two longitudinal bands somewhat green, one on each side; the two foremost pair of legs are very long and the hinder short, which makes it walk like a crab; it is found upon plants, and is a very lively, active, indefatigable hunter. Without any motion of the head, which is furnished with immoveable eyes, it perceives all the flies that hover round about, does not scare them, but stretches over them its arms furnished with feathers, which prove nets in which their wings entangle. It is said to sit on its eggs, which, however, it often conveys about with it, wrapt up in a ball of white silk.

11. The *Aquatica* is of a livid colour; with an oval belly, and a transverse line, and two hollowed

hollowed points. It frequents the fresh waters of Europe. But it is in some sort amphibious; for it can live on land as well as in the water, and comes often on shore for its food; yet it swims well in water, both on its belly and back: it is distinguishable by its brightness. In the water its belly appears covered with a silver varnish, which is only a bubble of air attached to the abdomen by means of the oily humours which transpire from its body, and prevent the immediate contact of the water. This bubble of air constitutes the substance of its dwelling, which it constructs under water; for it fixes several threads of silk, or such fine matter, to the stalks of plants in the water; and then ascending to the surface, thrusts the hinder part of its body above water, drawing it back again with such rapidity, that it attaches underneath a bubble of air, which it has the art of detaining under water, by placing it beneath the threads above-mentioned, and which it binds like a covering almost all round the air bubble. Then it ascends again for another air bubble; and thus proceeds, until it has constructed a large aërial apartment under water, which it enters into or quits at pleasure. The male constructs for

himself one near to the female; and when love invites, he breaks through the thread walls of the female's dwelling, and the two bubbles attached to the bellies of both, uniting in one, form one large nuptial chamber. The female is sometimes laid, for a whole day together, stretched on her back, waiting for the arrival of the male, without motion, and seemingly as if dead. As soon as he enters, and glides over her, she seems to be brought to life again, gets on her legs, and runs after the male, who makes his escape with all possible speed. The female takes care of the young, and constructs similar apartments on purpose for them. The figure of this spider has nothing remarkable; and would be overlooked among a crowd of curiosities, if the spectator be unacquainted with its singular art of constructing an aërial habitation under water, and thus uniting together the properties of both elements. It lodges during the winter in empty shells, which it dexterously shuts up with a web.

12. The *Fasciata*, with yellow bands round the bell, and dusky rings round the legs, is a native of Barbary, and is as large as the thumb. It inhabits hedges and thickets: its webs have large

large meshes, and it resides in the centre ; the snares are spread for larges flies, wasps, drones, and even locusts ; the lesser insects can escape through the meshes. The animal when entangled is soon bound with strong threads, killed by the spider's jaws, and partly eaten if the spider be hungry : the rest is concealed under some neighbouring dry leaves, covered with a kind of web and a blackish glue in great abundance : its larder is said to be often plentifully stored. Its nest is of the size of a pigeon's egg, divided horizontally, and suspended by the threads of the insect, which are of a silvery white, and stronger than silk. The young ones live in amity, but when grown up are mortal enemies ; they never meet but they fight with violence, and their battle only ends with the death of the weakest : the dead body is carefully stored in the larder. Twelve of these spiders, by way of experiment, were shut up together, and after a battle of eight days, the strongest only remained alive.

13. The *Turantula* has the breast and belly of an ash colour ; the legs are likewise ash coloured ; with blackish rings on the under part ; the fangs or nippers are red on the inner side, the rest being blackish ; two of its eyes are red, larger than the others, and placed in the front ;

front; four other eyes are placed in a transverse direction towards the mouth; the other two are nearer the back: it has two antennæ, or feelers. It is a native of Italy, Cyprus, Barbary and the East Indies. It lives in bare fields, where the lands are fallow, but not very hard; and from its antipathy to damp and shade, chuses for its residence the rising part of the ground facing the east. Its dwelling is about four inches deep and half an inch wide; at the bottom it is curved, and there the insect sits in wet weather, and cuts its way out if water gain upon it. It waves a net at the mouth of the hole. These spiders do not live quite a year: in July they shed their skin, and proceed to propagation; which, from mutual distrust, as they frequently devour one another, is a work undertaken with great circumspection. They lay about seven hundred and thirty eggs, which are hatched in the spring; but the parent does not live to see her progeny, having expired early in the winter. The ichneumon fly is their most formidable enemy.

The bite of the tarantula is said to occasion an inflammation in the part, which in a few hours brings on sickness, difficulty of breathing, and universal faintness; the person is afterwards afflicted

afflicted with a delirium and sometimes is seized with a deep melancholy; and the same symptoms return annually, in some cases, for several years, and at last terminate in death. Music, it has been pretended, is the only cure. A musician is brought, who tries a variety of airs, till at last he hits upon one that urges the patient to dance; the violence of which exercise, produces a proportionable agitation of the vital spirits, attended with a consequent degree of perspiration, the certain consequence of which is a cure. Such are the circumstances which have been generally related, and long credited, concerning the bite of this animal. Kircherus, in his *Musurgia*, gives a very particular account of the symptoms and cures, illustrated by histories of cases, among which he mentions a girl, who being bitten by this insect, could be cured only by the music of a drum. He then proceeds to relate, that a certain Spaniard, trusting to the efficacy of music in the cure of the frenzy occasioned by the bite of the tarantula, submitted to be bitten on the hand by two of these creatures, of different colours, and possessed of different qualities, the venom was no sooner diffused about his body, than the symptoms of the disorder began to appear: upon
which

which harpers, pipers, and other musicians, were sent for, who by various kinds of music endeavoured to rouse him from that stupor into which he had fallen; but here it was observed that the bites of the two insects had produced contrary effects; for by one he was incited to dance, and by the other restrained from it: and in this conflict of nature the patient died.

In his *Musurgia*, this author, attempting to account mechanically for the cure of the bite of the tarantula, by music, says of the poison, that it is sharp, gnawing and bilious, and that it is received and incorporated into the medullary substance of the fibres. With respect to the music, he says, that the sound of the chords have a power to rarify the air to a certain harmonical pitch; and that the air thus rarified, penetrating the pores of the patient's body, affects the muscles, arteries, and minute fibres, and incites him to dance; which exercise begets a perspiration in which the poison evaporates.

Unsatisfactory as this theory may appear, the belief of this strange phenomena has prevailed among the ablest of modern naturalists. Sir Thomas Brown, so far from disputing it, says, that since many attest the fact from experience, and that the learned Kircherus hath positively, averred

averred it, and set down the songs and tunes solemnly used for the cure of the disease; and since some also affirm that the tarantula itself will dance at the sound of music, he shall not at all question it. Farther, that eminent Italian Physician of the last century, Baglivi, a native of Apulia, the country where the tarantula is produced, has written a dissertation *De Anato-mia, morsu, et effectibus tarantulæ*. In this he describes the region of Apulia where the tarantula is produced, with the anatomy and figure of the insect and its eggs; he mentions particularly the symptoms that follow from the bite, and the cure of the disease by music, with a variety of histories of cures thus wrought, and many of them communicated by persons who were eye-witnesses of the process.

Ludovicus Valetta, a Celestine monk of Apulia, published at Naples, in the year 1706, a treatise upon this spider, in which he not only answers the objections of those who deny the whole circumstances, but gives, from his own knowledge, several instances of persons who had suffered this way, some of whom were of great families, and so far from being dissemblers, that they would at any rate, to avoid shame, have concealed the misfortune which had befallen

them. The Hon. Mr. Robert Boyle, in his treatise of *Languid and Unheeded Motions*, speaking of the bite of the tarantula, and the cure of the disease which follows it, by means of music, says, that having himself had some doubts about the matter, he was, after strict enquiry, convinced that the relations were in the main true. Lastly, Dr. Mead, in his *Mechanical account of Poisons*, has given an essay on the tarantula, containing the substance of the above relations, and which he endeavours to confirm by his own reasoning upon the subject:

Notwithstanding the number and weight of these authorities, and the general acquiescence of learned and ingenious men in the opinion that the bite of the tarantula is poisonous, and that the cure of the disorder occasioned by it is effected by music, we have reason to apprehend that the whole is a mistake. In the *Philosophical Transactions* for the year 1672, p. 406. is an extract of a letter from Dr. Thomas Cornelia, a Neapolitan Physician, to John Doddington, Esq; his Majesty's Resident at Venice, communicated by the latter, in which, speaking of his intention to send to Mr. Doddington some tarantulas, he says, meanwhile I shall not omit to impart to you what was related to me a few days

days since, by a judicious and unprejudiced person; which is, “that being in the country of Otranto, where these insects are in great numbers, there was a man, who thinking himself stung by a tarantula, shewed in his neck a small speck, about which in a short time there arose some pimples, full of a serous humour and that, in a few hours after, the poor man was afflicted with very violent symptoms, as syncope, very great agitations, giddiness of the head, and vomiting; but that without any inclination to dance, and without a desire to have any musical instrument: he miserably died within two days. The same person affirmed to me, that all those that think themselves bitten by tarantulas, except such as for evil ends feign themselves to be so, are for the most part young wanton girls, whom the Italian writers call *Dolci di Sale*; who by some particular indisposition falling into this melancholy madness, persuade themselves, according to the vulgar prejudice, to have been stung by a tarantula.”

Dr. Serao, an Italian physician, has written also an ingenious book upon this subject, in which he has effectually exploded this opinion as a popular error; and in the Philosophical Tran-

sactions, No. LX. for the year 1770. p. 236, is a letter from Dominico Cirillo, M. D. professor of natural history in the University of Naples, where in taking notice of Serao's book, he says that having had an opportunity of examining the effects of this animal in the province of Taranto, where it is found in great abundance, he finds that the surprising cure of the bite of the tarantula by music has not the least truth in it, and that it is only an invention of the people, who want to get a little money by dancing when they say the *tarantism* begins. He adds, "I make no doubt
" but sometimes the heat of the climate contri-
" butes very much to warm their imaginations,
" and throw them into a delirium, which may
" be in some measure cured by music; but se-
" veral experiments have been tried with the
" tarantulas, and neither man nor animals after
" the bite have had any other complaint than a
" very trifling inflammation upon the part, like
" that produced by the bite of the scorpion,
" which goes off by itself without any danger
" at all. In Sicily, where the summer is still
" warmer than in any part of the kingdom of
" Naples, the tarantula is never dangerous;
" and music is never employed for the cure of
" the pretended tarantism." Mr. Swinburn,
when

when in the country of the tarantula, was desirous of investigating minutely every particular relative to that insect ; but the season was not far enough advanced, and no *tarantati* (persons bitten, or pretended to have been bitten, by the tarantula) had begun to stir. He prevailed however upon a woman who had formerly been bitten, to act the part and dance the tarantata before him. Many musicians were summoned, and she performed the dance, as all present assured him, to perfection. At first she lolled stupidly on a chair while the instruments were playing some dull music, they touched, at length, the chord supposed to vibrate to her heart ; and up she sprung with a most hideous yell, staggered about the room like a drunken person, holding a handkerchief in both hands, raising them alternately, and moving in very true time ; as the music grew brisker, her motions quickened, and she skipped about with great vigour, and variety of steps, every now and then shrieking very loud. The scene was far from pleasant ; and at his desire an end was put to it before the woman was tired.

He further informs us that whenever the *tarantati* are to dance, a place is hung round with bunches of grapes and ribbons ; the patients are
dressed

dressed in white, with red, green, or yellow ribbons, for those are their favourite colours; on their shoulders they cast a white scarf, let their hair fall loose about their ears, and throw their heads as far back as they can bear it: they are, in fact, exact copies of the ancient priestesses of Bacchus. The orgies of that god, whose worship, under various symbols, was more widely spread over the globe than that of any other divinity, were no doubt performed with energy and enthusiasm by the lively inhabitants of this warm climate. The introduction of Christianity abolished all public exhibitions of these heathenish rites, and the women durst no longer act a frantic part in the character of Bacchantes. Unwilling to give up so darling an amusement, they devised other pretences, and possession by evil spirits may have furnished them with one. Accident may also have led them to a discovery of the tarantula; and upon the strength of its poison, the Puglian dames still enjoy their old dance, though time has effaced the memory of its ancient name and institution; and this Mr. Swinburn takes to be the origin of so strange a practice. If at any time these dancers are really and involuntarily affected, he supposes it can be nothing more than an attack upon their
nerves,

nerves, a species of St. Vitus's dance; and he inclines the more to the idea, as there are numberless churches and places throughout these provinces dedicated to that saint.

Many sensible people of the country, however, differ, in opinion, from Dr. Serao and other authors, who have ridiculed the pretended disorder, and have affirmed that the venom of this species of spider can produce no effects but such as are common to all other. The Brindisians say, that the tarantulas sent to Naples for the experiment were not of the true sort, but were much larger and more innocent; and that the length of the journey, and want of food, had weakened their power so much, as to fuffer the Doctor, or others, to put their arm into a bag where they were kept with impunity. They quote many examples of persons being bitten as they slept out in the fields during the hot months, who grew languid, stupid, deprived of all courage and elasticity, till the sound of some favourite tune roused them to dance, and throw off the poison. These arguments, however, Mr. Swinburn thinks of little weight, for they acknowledge that elderly persons were more frequently afflicted than young ones; and that most of them were
women

women, and those unmarried. He says, that no person above the lowest rank was ever seized with this malady, nor is there an instance of its causing death. The length of the dance, and the patient's power of bearing such excessive fatigue in the canicular season, prove nothing; because every day at that time of the year, peasants may be seen dancing with equal spirits and perseverance, though they do not pretend to be seized with the tarantism.

The illness may, therefore, be attributed to hysterics, excessive heat, stoppage of perspiration, and other effects of sleeping out of doors in a hot summer air, which is always extremely dangerous, if not mortal, in most parts of Italy. Violent exercise may have been found to be a certain cure for this disorder, and continued by tradition, though the date and circumstances of this discovery have long been buried in oblivion; a natural passion for dancing, imitation, custom of the country, and a desire of raising contributions upon the spectators, are probably the real motives, that inspire the tarantati. Before Serao's experiments, the tarantula had been proved to be harmless, from trials made in 1693 by Clarizio, and in 1740 at Lucera, by other naturalists.

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The *Flea*. Of all the insect tribe this is, by far, the most agile and active: its power of springing indeed is wonderful for its size, being capable of bounding more in height than two hundred times the bulk of its whole body; and some naturalists have been induced to attribute to it a degree of cunning and sagacity no less extraordinary; for they say that it makes its approach for an attack with as much caution, as it effectuates its escape with art and velocity; but this is, perhaps, allowing the flea a greater share of instinct than it, in reality, has any pretensions to; for although it certainly appears to exert a variety of manœuvres to save its life, and to preserve its freedom, yet that may probably be accounted for from the diminutiveness of its size, and the elasticity of its limbs; and as to its precaution in making its attacks, whatever individuals may imagine that they have observed, the flea hastily approaches the body that is warm, and greedily attacks those pores through which the blood can most easily be procured.

Numerous as these insects are, and notwithstanding that they are found in every part of the known world, yet their tormenting depredations are mostly confined to men and domestic

animals, such as the dog, cat, poultry, pigeons, &c. In the warm climates they are in the greatest abundance, particularly in the southern parts of France and Italy, but in the northern they are by much the most tormenting; and Goldsmith says, the bite of the flea is more troublesome in England than he ever found it in any other place. If it be examined with a microscope, the flea will be observed to have a small head, large eyes, and a roundish body. It has two feelers, or horns, which are short, and composed of four joints, and between these lies its trunk, which it buries in the skin, and through which it sucks the blood in large quantities. The body appears to be curiously adorned all over with a suit of polished sable armour, neatly jointed, and beset with a great number of sharp pins, almost like the quills of a porcupine. It has six legs, the joints of which are so adapted, that it can, as it were, fold them up one within another, and when it leaps they all spring out at once, in which effort its whole strength is exerted, and the body thrown, comparatively, to a considerable distance. The flea deposits a multitude of nits, or eggs, which are round and smooth, and from these proceed white worms, of a shining pearl colour;

colour; in a fortnight's time they come to a tolerable size, and are very lively and active; but if they are touched at this time, they roll themselves up in a ball: soon after this they begin to creep like silk-worms that have no legs, and then they seek a place to hide themselves in, where they spin a silken thread from their mouth, and with this they enclose themselves in a small round bag or case, as white within as writing paper, but dirty without; in this they continue for a fortnight longer; after which they burst from their confinement perfectly formed, and armed with powers to disturb the rest even of a tyrant.

The *Louse*. This insect, observes an ingenious writer, is not only the most disagreeable, but also the most inveterate tormentor of man; for wherever misfortune sends her train of wretchedness, disease, and hunger to beset him, the louse seldom fails to add itself to the tribe, and to increase in proportion to the number of his calamities.

When the *human louse* is examined with the microscope, the shape of the fore-part of the head appears to be somewhat oblong; that of the hind-part somewhat round; the skin is hard,

and being stretched, transparent, with here and there several bristly hairs; in the fore-part is a proboscis, or sucker, which is seldom visible; on each side of the head are antennæ, or horns, each divided into five joints, covered with bristly hair; and several other white vessels are seen through these horns; behind these are the eyes, which seem to want those divisions observable in other insects; and appear encompassed with some few hairs; the neck is very short, and the breast is divided into three parts; on each side of which are placed six legs, consisting of six joints, covered also with bristly hairs; the ends of the legs are armed with a large and a small ruddy claw, serving them as a finger and thumb, by which they catch hold of such objects as they approach; the end of the body terminates in a cloven tail, while the sides are covered with hair, the whole resembling clear parchment, and, when roughly pressed, cracking with a noise. On a closer view its white veins, and other internal parts become apparent, as likewise a most wonderful motion in its intestines, from the transparency of its external covering. When the louse feeds, the blood is seen to rush like a torrent, into the stomach; and its greediness is so great, that the excrements contained
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in the intestines are ejected at the same time, to make room for this new supply.

The louse has neither beak, teeth nor any kind of mouth. In the place of all these it has a proboscis, or trunk; or as it may otherwise be called, a pointed hollow sucker, with which it pierces the skin, and sucks the human blood, taking that alone for food. The stomach is lodged partly in the breast and back; but the greatest portion of it is in the abdomen. When empty, it is colourless, but when filled, it is plainly discernible, and its motion seems very extraordinary. It then appears working with very strong agitations, and somewhat resembles an animal within an animal. Superficial observers are apt to take this for the pulsation of the heart; but if the animal be observed when sucking, it will then be seen that the food takes a direct passage from the trunk to the stomach, where the remainder of the old aliment may be observed mixing with the new, and agitated up and down on every side. If this creature be kept from food two or three days, and then placed upon the back of the hand, or any soft part of the body, it will immediately seek for food; and which it will the more readily find if the place be rubbed until it grows red. The
animal

animal then turns its head, which lies between the two fore-legs, to the skin, and diligently searches for some pore; when found it fixes the trunk into it, and soon, with the microscope, the blood may be discovered ascending through the head, in a very rapid stream. The louse will, at that time, feed in any posture, even with its head downward, and its tail elevated. If, during this operation, the skin be drawn tight, the trunk becomes bound fast, and the animal is incapable of disengaging itself; but it more frequently suffers from its gluttony, since it gorges to such a degree that it is crushed to pieces with the slightest impression.

The most assiduous examiners of this part of the creation have not been able to discover whether lice are divided into sexes. Swammerdam, who was indefatigable in his pursuits, after having dissected no less than forty-two, was of opinion they were hermaphrodites, having discovered an ovary in every one of which he dissected; in one of them, he says, he found ten large eggs, and forty-four smaller that were not come to their full perfection.

Scarcely any creature in the animal creation multiplies so fast as the louse. It is a popular expression, that a louse becomes a grandfather
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in the space of twenty-four hours; this cannot be ascertained as a fact, but nothing is more true than that the moment the nit, which is no other than the egg of the louse, gets rid of its superfluous moisture, and throws off its shell, it begins to breed in its turn. Nothing so much prevents the encrease of this nauseous animal as cold and want of humidity; the nits must be laid in a place that is warm and moist to produce any thing.

This nauseous insect is equally troublesome on every part of the human body, and among the ancients what is called the *phiriasis* or *lousy disease*, was not uncommon; Antiochus, Herod Epiphanes, Alcman, the poet, Pherecydes, Cassander, Callisthenes, Sylla, and several others are said to have died of that disorder. The use of mercury, which was unknown among the ancients, may probably have relieved the moderns.

So general is this tribe of insects, that there is scarcely an animal or vegetable which does not suffer the persecutions of its own peculiar louse. The sheep, the horse, the hog, and the elephant are all teized by them: the whale, the shark, the salmon, and the lobster, are not without their company; while every hot-house, and every

every garden is infested with some peculiarly destructive. Linnæus tells us, that he once found a vegetable louse upon some plants newly arrived from America ; and willing to trace the little animal through its various stages, he took it with him from London to Leyden, where he carefully preserved it during the winter, until it bred in the spring ; but the louse it seems did not treat him with all the gratitude he expected ; for it became the parent of so numerous a progeny, that it soon overrun all the physic-garden of that beautiful city ; and leaves, to this day, many a gardener to curse the Swede's too indulgent curiosity.

The animal which some have called the *Leaf Louse*, is of the size of a flea, and of a bright green, or bluish green colour ; the body is nearly oval, and is largest and most convex on the hinder part ; the breast is very small, and the head is blunt and green ; the eyes may be seen very plainly, being prominent on the front part of the head, and of a shining black colour ; near these there is a black line on each side ; and the legs are very slender. These animals are usually found upon the leaves of the orache, and other plants ; and the weaker the leaves and buds are, in the greater abundance do these insects

swarm upon them. Some plants are covered over with them; though they are not the cause of the plant's weakness, but the sign: however, by wounding and sucking the leaf, they increase the disease. They generally assume their colour from the plant on which they reside. Those that feed upon pot herbs and plumb-trees, are of an ash-colour; but they are greenish when they are young; those that belong to the alder and cherry-tree, are black; as are also those upon beans, and some other plants: those on the leaves of apples and rose trees, are white; but as they leap like grasshoppers, some place them in the number of the flea kind. The most uncommon colour is reddish; and lice of this sort may be found on the leaves of tansey; and their juice, when rubbed in the hands, tinges them with no disagreeable red. All these live upon their respective plants; and are often engendered with in the very substance of the leaf.

All these produce their young alive; and the foetus, when it is ready to be brought forth, entirely fills the belly of the female; its fore parts being excluded first, and then the hinder. The young one does not begin to move till the horns, or feelers, appear out of the body of the

old one; and by the motion of these it first shews signs of life, moving them in every direction, and bending all their joints. When the horns and head are excluded, the two fore feet follow, which they move with equal agility; after this follow the middle feet, and then the hinder: still, however, the young one continues sticking to its parent, supported only at one extremity, and hanging, as it were, in air, until its small and soft members become hardened and fitted for self-support. The parent then gets rid of its burthen; by moving from the place where she was sitting, and forcing the young one to stand upon its legs, leaves it to shift for itself.

As the animal has not far to go, its provision lying beneath it, it continues to eat and creep about with great agility during the summer. But as it is viviparous, and must necessarily lurk somewhere in winter, where its body may be defended from the cold, it endeavours to secure a retreat near the trees or plants that serve to nourish it in the beginning of spring. They never hide themselves in the earth, like many other insects, because they have no part of their bodies fitted to remove the earth, nor can they creep into every chink, as their legs are too long;

long; besides, their bodies are so tender, that the least rough particle of the earth would hurt them. They get therefore into the deep chinks of the bark, and into the cavities of the stronger stalks, whence they sally out upon the branches and leaves, when the warmth of the sun begins to be felt. Neither the cold in the autumnal season, nor the lesser degree of heat in the spring, ever hurts them; they seldom, therefore, seek for hiding-places before the fall of the leaf, and are alert enough to take the earliest advantage of the returning spring.

Like many other insects, they cast their skins four several times; and, what is very remarkable, the males have four wings, but the females never have any. All of them have long legs, not only to enable them to creep over the long hairs of plants and leaves, but also to travel from one tree to another, when they happen to stand at a distance. Their trunk, or snout, lies under their breast; and this they thrust into the pores of the plant to suck out the juice, for they do not gnaw them, like the caterpillar; but they hurt them so much by sucking, that the leaves become spotted, and as it were overrun with scabs; for which reason their edges always turn towards the middle.

It has been said, that these insects are often carried away and devoured by ants; but this, Frysch, from whom this description is taken, could never observe. The ants indeed are fond of those trees where there is a great number of those insects; but then it is only to suck the juice which flows from the leaves that have been just wounded. This more particularly happens in the heat of summer, when other moisture is wanting: but he never found them hurting or carrying away any of these insects while alive; nor indeed are they able, for the leaf louse is more than a match for the ant at single combat. Whenever they perceive the ant approaching behind them, they kick back with the hinder feet, and thus drive off the invader, as a horse would a lion.

The three principal and constant enemies to these insects are first, the fire-fly, which lays its eggs where these insects are in greatest number, and which, producing a worm, seizes and devours all the leaf lice that come near it; another enemy is the worm of a peculiar kind of beetle, which destroys them in great numbers; but the most formidable of all enemies, is the ichneumon fly, that seizes upon one of the
largest

largest females, and laying its egg upon her, this is hatched into a worm, which soon devours and destroys the animal from whose body it sprung.

The *common Wood louse* is seldom above half an inch long, and a quarter of an inch broad. The colour is of a livid black, especially when found about dung-hills, and on the ground; but those that are to be met with under tiles, and in drier places, are of the colour of the hair of an ass. It has fourteen feet, seven on each side; and they have only one joint each, which is scarcely perceivable. It has two short feelers, and the body is of an oval shape. When it is touched, it rolls itself up in a sort of ball: and the sides, near the feet, are dentated, like a saw. It is often found among rotten timber, and on decayed trees: in winter it lies hid in the crevices of walls, and all sorts of buildings. The male is easily distinguished from the female, being less, and more slender. The eggs they lay are white and shining, like seed pearls, and are very numerous; more properly speaking, however, when excluded, the young have all the appearance of an egg, yet they are alive, and, without throwing off any shell, stir and move

move about with great vivacity; so that this animal may strictly be said to be viviparous. The little worms at first seem scarcely able to stir; but they soon feed, and become very brisk. These animals are much used in medicine, as they are impregnated with a saline quality, which is diuretic and stimulating. Of this insect Linnaeus makes three species.

The *Bug* is another of those nauseous insects that intrude upon the retreats of mankind, and often banish that sleep, which even sorrow and anxiety permitted to approach. This, to many men, is of all insects, the most troublesome and obnoxious. The night is the only season when the bug issues from its retreats, to make its depredations. By day it lurks, like a robber, in the most secret parts of the bed: takes advantage of every chink and cranny, to make a secure lodgment; and contrives its habitation with so much art, that scarcely any industry can discover its retreat. It seems to avoid the light with great cunning; and even if candles be kept burning, this formidable insect will not issue from its hiding place. But, when darkness promises security, it then issues from every corner of the bed, drops from the tester, crawls
from

from behind the arras, and travels, with great assiduity, to attack those who have retired to rest. It is generally in vain that you destroy one only, since there are hundreds more to revenge their companion's fate ; so that the person who is thus subject to be bitten, remains the whole night, like a centinel upon duty, rather watching the approach of fresh invaders, than inviting the pleasing approaches of sleep.

Nor are these insects less disagreeable from their nauseous stench, than their unceasing appetites. When they begin to crawl, the whole bed is infected with the smell ; but if they are accidentally killed, it is then insupportable.

These are a part of the inconveniences that result from the persecution of these odious insects : but happily for Great Britain, they multiply less in that island, than in any part of the continent. In France and Italy the beds swarm with them ; and every place of furniture seems to afford them a retreat. They grow larger also with them than in England, and bite with more cruel appetite.

This animal, if examined minutely, appears to consist of three principals parts ; the head, the corselet, and the belly. It has two brown eyes, that are very small, and a little prominent, besides

besides two feelers, with three joints; underneath these there is a crooked trunk, which is its instrument of torture, and which, when in motion, lies close upon the breast. The breast is a kind of ring, in which are placed the first two pair of legs. The belly consists of nine rings, under which are placed two pair of legs more. Each leg has three joints, which form the thigh, the leg and the foot, the last being armed with a crooked claw, like a hook. The body is smooth, except a few short hairs, that may be seen by the microscope, about the vent, and on the last rings. It is particularly attached to the darkness of the night, and constantly makes a hasty retreat at the approach of any light.

Upon an internal examination, the bug appears to have the great artery which, in all insects, performs the functions of the heart; it has the apertures of the lungs on both sides, through which it breathes; the stomach and intestines, as in other animals, run from the mouth to the anus: if it has been long fasting, there will be a mucus found in its body, like the white of an egg; but if crushed, after a full meal, the human blood, which it has suck-

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ed in, will appear a little darkened by having passed through the insect's body.

The male and female of these animals are plainly distinguishable from each other, and the parts of generation are obvious enough. They are often found coupling tail to tail. The female has an ovary filled with eggs, joined together like a bunch of grapes; each egg being oblong, almost cylindrical, inclining to white, and pretty transparent. In about two days after impregnation she deposits her eggs, to the number of about one hundred and fifty, in some concealed place; there they continue for some months, during which time neither cold nor heat, neither moisture nor fumigation, can in the least retard their exclusion, but they come forth active, and ready for mischief. It is this hardness in the shell that seems to preserve the breed, as the old ones die every winter, or are easily destroyed by fumigation; but the eggs appear proof against destruction. Cleanliness is, most certainly, the best antidote to guard against these nauseous insects, and wherever that is wanting their increase seems but a just punishment. They are sometimes found in such numbers among old furniture, and neglected chambers exposed to the south, that, wanting other

sustenance, they devour each other. They are also enemies to other vermin, and destroy fleas very effectually. Of the bug kind Linnæus reckons forty varieties.

The *Monoculus*, or *Arborescent Water-flea*, is about the size of a common flea; it appears to the sight, unassisted by the microscope, to have but one eye, for the eyes, in consequence of the smallness of the head, seem to be joined to each other: they are situated in the trunk, and the beak is likewise very small and sharp pointed. The structure of the eye is seen by the microscope to be reticulated, or made like a net; and the trunk, by which it feeds, is not only small and sharp, but also transparent. They are of a blood red colour, and sometimes are seen in such multitudes on the surface of standing water, as to make it appear entirely red.

Swammerdam tells us of a celebrated professor at Leyden, who was, at first, much astonished by an appearance of this kind. Being one day intent upon his studies he was disturbed by a noise, and calling up the servant to know the cause, she told him, quite in a fright and with a tremulous voice, that all the waters of
Leyden

Leyden were turned into blood! He went directly to the place where the water was said to be thus changed, and put some of it into a glass: he was himself much astonished at first, but upon viewing it with attention, he observed that it abounded with infinite numbers of these little red insects, which tinged the whole body of the fluid with that seemingly formidable colour.

This little animal has several branching arms with which, when in the water, it can move in a straight line, waving them as a bird does its wings in the air, sometimes upward, sometimes downward, sometimes to the right, sometimes to the left, yet still continuing to proceed in a right line. By striking the water with its arms, it can ascend with great velocity; and by striking in a contrary direction, it dives with equal ease. As these motions are very rapid, the little animal appears to jump in the water, its head always tending to the surface, and its tail stretching downward. This insect is produced from an egg, which, when excluded, is carried on the back of the female, and soon after is seen floating in the water round her. When excluded from the egg its appearance is that of a small whitish insect, endued

with a very nimble motion. It undergoes no change in form, but continues to encrease in redness, as it grows older and larger. They sometimes remain several days on the surface of the water, and sometimes are seen at the bottom only, but they are never at rest. They change their skin like most other insects; and the cast skin resembles the insect itself so exactly, that one might mistake the mask for the animal.

The *Scorpion* is one of the largest of the insect tribe, and no less terrible from its size than from its malignity. It resembles a lobster somewhat in shape, but is infinitely more hideous. There have been nine different kinds of this dangerous insect enumerated, but which are chiefly distinguished by their colour: some are yellow, brown, and ash coloured; others the colour of rusty iron, green, pale, yellow, black, claret colour, white and grey.

There are four principal parts distinguishable in this animal; the head, the breast, the belly, and the tail. The scorpion's head seems, as it were, jointed to the breast; in the middle of it are seen two eyes; and a little more forward, two eyes more, placed in the forepart of the

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the head: these eyes are so small, that they are scarcely preceivable; and it is probable that the animal has but little occasion for seeing. The mouth is furnished with two jaws; the undermost is divided into two, and the parts notched into each other, which serve the animal for teeth to break its food, and thrust it into its mouth: these he can at pleasure pull back into its mouth, so that no part of them can be seen. On each side of the head are two arms, each composed of four joints: the last of which is large; with strong muscles, and made in the manner of a lobster's claw. Below the breast are eight articulated legs, each divided into six joints; the two hindmost of which are each provided with two crooked claws, and here and there covered with hair. The belly is divided into seven little rings; from the lowest of which is continued a tail composed of six joints, which are bristly, and formed like little globes, the last being armed with a crooked sting. This is that fatal instrument which renders this insect so formidable; it is long, pointed, hard, and hollow; it is pierced near the base by two small holes, through which, when the animal stings, it ejects a drop of poison, which is white, caustic, and fatal.

fatal. The reservoir in which this poison is kept, is in a small bladder near the tail, into which the venom is distilled by a peculiar apparatus. If this bladder be gently pressed, the venom will be seen issuing out through the two holes above-mentioned; so that it appears, that when the animal stings, the bladder is pressed, and the venom issues through the two apertures into the wound.

There are few animals more formidable, or more truly mischievous than the scorpion. As it takes refuge in a small place, and is generally found sheltering in houses, it must of course frequently sting those among whom it resides. In some of the towns of Italy, and in France, in the province of Languedoc, it is one of the greatest pests that torment mankind: but its malignity in Europe is trifling, when compared to what the natives of Africa and the East are known to experience. In Batavia, where they grow twelve inches long there is no removing any piece of furniture, without the utmost danger of being stung by them.

Bosman assures us, that, along the Gold Coast, they are often found larger than a lobster; and that their sting is inevitably fatal.

In

In Europe, the general size of this animal does not exceed two or three inches; and its sting is very seldom found to be fatal.

Maupertuis, who made several experiments on the scorpion of Languedoc, found it to be by no means so invariably dangerous as had till then been represented. He provoked one of them to sting a dog in three places of the belly, which were without hair: in about an hour afterwards the poor animal seemed greatly swollen, and he became very sick; he then cast up what he had in his stomach, and for about three hours continued vomiting a whitish liquid. His belly was always very much swollen when he began to vomit; this operation seemed to abate the swelling, which alternately encreased and was thus reduced for three hours successively. The poor animal, after this, fell into convulsions, bit the ground, dragged himself along upon his fore feet, and at last died, about five hours after he had been bitten. Some days after, however, the same experiment was tried upon another dog, and even with more aggravated cruelty, yet the dog seemed no way affected by the wounds, but howling a little when he received them, continued perfectly alert, and was soon after set at liberty, without shewing

shewing the smallest symptom of pain. The same experiment was tried, by fresh scorpions, upon seven other dogs, and three hens, but not the smallest deadly symptom was seen to ensue. From hence it appears, that many circumstances, which are utterly unknown, must contribute to give efficacy to the scorpion's venom. Whether its food, long fasting, the season, the nature of the vessels it wounds, or its state of maturity, contribute to, or retard its malignity, is yet to be ascertained by succeeding experiments. In the trials made by M Maupertuis, he employed scorpions of both sexes, newly caught, and seemingly vigorous and active.

The scorpion of the torpical climates being much larger is, probably, much more venomous. Helbigius; however, who resided for many years in the east, assures us that he was often stung by the scorpion, and never received any material injury from the wound: a painful tumour, he says, generally ensued, but he always cured it, by rubbing the part with a piece of iron or stone in the same manner as he had seen the Indians, until the flesh became insensible. Seba, Moore, and Bosman, nevertheless, give a very different account of the scorpion's malignity; they assert

assert that, unless immediately relieved, the wound becomes fatal.

Of all animals in the creation the scorpion is the most irascible. When taken they act with perfect fury; they rush against the sides of the vessel in which they are enclosed, and endeavour to sting every thing which comes near them. Maupertuis put three scorpions and a mouse into the same vessel together, and they all immediately stung the little animal in different places: the mouse, thus assaulted, stood for some time upon the defensive, and at last killed them all, one after the other, and even survived the severity of the wounds it had received.

Wolkamer tried the courage of the scorpion against the large spider, and enclosed several of both kinds in glass vessels for that purpose. The spider at first used all its efforts to immesh the scorpion in its web, which it immediately began spinning; but the scorpion rescued itself from the danger, by stinging its adversary to death: it soon after, with its claws, cut off all the legs of the spider, and then sucked all the internal parts at its leisure.—If the scorpion's skin had not been so hard, Wolkamer was of opinion, that the spider would have obtained the victory,

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for he had often seen one of the same kind of spiders overcome and kill a toad.

It is not to others alone but also to their own species that this ferocity of temper is dangerous, for they are the most inveterate of enemies to each other. Maupertuis put about a hundred of them together in the same glass ; and they scarcely came into contact, when they began to exert all their rage in mutual destruction : there was nothing to be seen but one universal carnage, and in a very few days there remained only fourteen, which had killed and devoured all the rest.

But their unnatural malignity is still more apparent in their cruelty to their offspring. The same author enclosed a female scorpion, big with young, in a glass vessel, and she was seen to devour them as fast as they were excluded ; there was but one that escaped the general destruction, and that by taking refuge on the back of its parent ; and this soon after revenged the cause of its brethren, by killing the old one in its turn. Such is the ferocious nature of this insect ; nay, it is asserted, that when driven to an extremity it will even destroy itself. Goldsmith says that he was informed by a person who made the experiment in America, and on

whose veracity he could rely, that a scorpion, newly caught, being placed in the midst of a circle of burning charcoal, and thus an egress prevented on every side, it ran, for about a minute, round the circle, seeking for a place to escape, but finding that impossible, it stings itself on the back of the head, and by which wound the undaunted suicide instantly expires.

If these animals were not so destructive to each other, they would multiply in so great a degree as to render some countries almost uninhabitable. The male and female of this insect are very easily distinguishable; the male being smaller and less hairy. The female brings forth her young alive, and perfect in their kind. Rhedi, having procured a quantity of scorpions, selected the females from the rest, and putting them into separate glass vessels, he kept them a few days without food. In about five days one of them brought forth thirty-eight young ones, well shaped, and of a milk white colour, which changed every day more and more into a dark rusty hue. Another female, in a different vessel, brought forth twenty-seven of the same colour; and the day following the young ones seemed all fixed to the back and belly of the female. For nearly a fortnight all these continued

alive and well, but afterwards some of them died daily, and in about a month they were all dead except two.

Were it worth the trouble, these animals might be kept living for a considerable time. Their chief food is worms and insects, and with a proper supply of those their lives might most probably, be preserved to their natural extent; how long indeed that may be has not been exactly ascertained, but if we may conclude from analogy, it cannot be less than seven or eight years, and, perhaps, in the larger kind, double that period. As they resemble the lobster in appearance, so likewise they cast their skin as the latter does its shell, which is, however, softer and covered with hair, particularly at the joinings. The young lie in the womb of the parent, each covered up in its own membrane, and united to each other by an oblong thread, so as to exhibit altogether the form of a chaplet.

There is however, a scorpion of America produced from the egg in the manner of the spider. The eggs are not larger than the point of a pin, and they are deposited in a web which they spin from their bodies, and carry about with them, till they are hatched. As soon as the

the young ones are excluded from the shell, they get upon the back of the parent, who turns her tail over them, and defends them with her sting.

The *Scolopendra* and *Gally-worm*. Of these hideous and angry insects we know little, excepting the figure and their noxious qualities. With us they seldom grow above an inch long; in the tropical climates they are often found above a quarter of a yard.

The *Scolopendra* is otherwise called the *Cen-tipes*, from the number of its feet; and is very common in many parts of the world, especially between the tropics. Those of the East Indies, where they grow to the largest size, are about six inches long, of a ruddy colour, and as thick as a man's finger: they consist of many joints, and from each joint is a leg on each side; they are covered with hair, and seem to have no eyes; but there are two feelers on the head, which they make use of to find out the way they are to pass: the head is very round, with two small sharp teeth, with which they inflict wounds that are very painful and dangerous. A sailor that was bitten by one on board a ship, felt an excessive pain, and his life was supposed to be in danger: however, he recovered

vered, by the application of three roasted onions to the part; and was soon quite well *. Of this animal there are different kinds; some living like worms, in holes in the earth; and others under stones, and among rotten wood: so that nothing is more dangerous than removing those substances, in the places where they breed.

The *Gally-worm* differs from the scolopendra, in having double the number of feet; there being two on each side, to every joint of the body. Some of these are smooth, and others hairy; some are yellow, some black, and some brown. They are found among decayed trees, between the wood and the bark; as also among stones that are covered with moss. They all, when touched, roll themselves up like a ball. Whatever may be their qualities in the tropical parts of the world, in Europe they are perfectly harmless; having been often handled and irritated without any vindictive consequences.

All these, as well as the scorpion, are supposed to be produced perfect from the parent, or the egg; and to undergo no changes after their first exclusion. They are seen of all sizes;

and

* In some countries, Spain for example, it is generally believed that spirits of wine, in which a Centipes is preserved, will cure its bite, and accordingly almost every person provides himself with one so preserved as an antidote.

and this is a sufficient inducement to suppose, that they preserve their first appearance, through the whole of their existence. It is probable, however, that, like most of this class, they often change their skins; but of this we have no certain information.

The *Leech*, from its uses in medicine, is one of those insects that man has taken care to propagate; but of a great variety, one kind only is considered as serviceable. The *horse-leech*, which is the largest of all, and grows to four inches in length, with a glossy black surface, is of no use, as it will not stick to the skin; the *snail-leech* is but an inch in length; and though it will stick, is not large enough to extract a sufficiently quantity of blood from the patient; the *broad-tailed leech*, which grows to a inch and a half in length, with the back raised into a sort of ridge, will stick but on very few occasions; it is the large *brown leech* with a whitish belly, that is made use of in medicine, and whose history best merits our curiosity.

The leech has the general figure of a worm, and is about as long as one's middle finger. Its skin is composed of rings, by means of which

which it is possessed of its agility, and swims in water. It contracts itself, when out of water, in such a manner, that when touched, it is not above an inch long. It has a small head, and a black skin, edged with a yellow line on each side, with some yellowish spots on the back. The belly also, which is of a reddish colour, is marked with whitish yellow spots. But the most remarkable part of this animal is the mouth, which is composed of two lips, that take whatever form the insect finds convenient. When at rest, the opening is usually triangular; and within it are placed three very sharp teeth, capable of piercing not only the human skin, but also that of a horse or an ox. Still deeper in the head is discovered the tongue, which is composed of a strong fleshy substance, and which serves to assist the animal in sucking, when it has inflicted its triple wound; for no sooner is the voracious creature applied to the skin, than it buries its teeth in it, then closes its lips round the wound which it has made; and thus, in the manner of a cupping-glass, extracts the blood as it flows to the different orifices.

In examining this animal's form farther towards the tail, it is seen to have a gullet, and

an intestinal canal, into which the blood flows in great abundance. On each side of this are several little bladders, which, when the animal is empty, seem to be filled with nothing but water; but when it is gorging blood, they seem to communicate with the intestines, and receive a large portion of the blood which flows into the body. If these bladders should be considered as so many stomachs, then every leech will be found to have twenty-four. But what is the most extraordinary in this animal's formation is, that though it takes so large a quantity of food, it has no anus or passage to eject it from the body when it has been digested. On the contrary, the blood which the leech has thus sucked, remains for several months clotted within its body, blackened a little by the change, but no way putrified, and very little altered in its texture or consistence. In what manner it passes through the animal's body, or how it contributes to its nourishment, is not easily accounted for. The water in which they are kept is very little discoloured by their continuance; they cannot be supposed to return the blood by the same passage through which it was taken in; it only remains, therefore, that

it goes off through the pores of the body, and that these are sufficiently large to permit its exclusion.

But it is not in this instance alone that the leech differs from all other insects. It has been remarked in a former section, that the whole insect tribe had their opening into their lungs placed in their sides; and that they breathed through those apertures as other animals through the mouth. A drop of oil poured on the sides of a wasp, a bee, or a worm, would quickly suffocate them, by stopping up the passages through which they breathe; but it is otherwise with the leech, for this animal may be immersed in oil without injury; nay, it will live in it; and the only damage it will sustain is that when taken out, it will be seen to cast a fine pellucid skin, exactly of the shape of the animal, after which it is alert and vigorous as before. It appears from this, that the leech breathes through the mouth; and, in fact, it has a motion that seems to resemble the act of respiration in more perfect animals: but concerning all this we are very much in the dark.

The leech is viviparous, and produces its young, one after the other, to the number of
forty

forty or fifty at a birth. It is probable, that like the snail, each insect contains the two sexes, and that it impregnates, and is impregnated in the same manner. The young ones are chiefly found in the month of July, in shallow running waters, and particularly where they are tepified by the rays of the sun. The large ones are chiefly sought after; and being put into a glass vessel filled with water, they remain for months, nay for years, without taking any other subsistence. But they never breed in this confinement; and, consequently, what regards that part of their history still remains obscure.

In this part of the world they seldom grow to above four inches; but in America and the East they are found from six to seven. Their pools there abound with them in such numbers, that this circumstance alone would render it dangerous to bathe. Even in some parts of Europe they increase so as to become formidable. Sedilius, a German physician, relates, that a girl of nine years old, who was keeping sheep near the city of Bombst, in Poland, perceiving a soldier making up to her, went to hide herself in a neighbouring marsh among

some bushes; but the number of leeches was so great in that place, and they stuck to her so close, that the poor creature expired from the quantity of blood which she lost by their united efforts. Nor is this much to be wondered at, since one of those insects, that, when empty, generally weighs but a scruple, will, when gorged, weigh more than two drachms.

When leeches are to be applied, the best way is to take them from the water in which they are contained, about an hour before, for they thus become more voracious, and fasten more readily; when saturated with blood, they generally fall off of themselves; but by sprinkling them with a little salt, if they adhere too long, they may be taken off at any time.

Though the leech so closely resembles the worm, it certainly has a claim to rank in a superior order of nature; for if the worm be cut in two, each part continues to live, but the leech being severed there is an end to its existence.



Beetle



Dragon Fly



Gnat.



Flies.



Locust.



Grasshopper.

THE SECOND ORDER OF INSECTS:

THE second order of insects is those that are produced from the egg, like the former, but not in a perfect state; for, when first excluded, they are without wings; in which state, the insect possess the exercise of all its animal functions, for it can walk, leap, and eat; nor is it at any time deprived of motion, only it rests a little when it is about to cast that part of its skin previously to its coming to a state of perfection.

To this order, we may, in the first place, refer the *Libella* or *Dragon-fly*.

Of all the flies which adorn or diversify the face of Nature, these are the most various and the most beautiful; they are of all colours; green, blue, crimson, scarlet, white, &c. while others are adorned with all the various tints of the rainbow.

They are distinguished from all other flies by the length of their bodies, by the largeness of their eyes, and the beautiful transparency of their wings, which are four in number. They are seen in summer flying with great rapidity near every hedge, and by every running brook; they sometimes settle on the leaves of plants, and sometimes keep for hours together on the wing.

Dragon-flies, though there are three or four different kinds, yet agree in the most striking parts of their natural history, and one account may serve for all. The largest sort are generally found from two to three inches long; their tail is forked; their body divided into eleven rings; their eyes are large horny, and transparent, divided by a number of intersections and their wings, that always lie flat when they are at rest, are of a beautiful glossy transparency; sometimes shinning like silver, sometimes glistening like gold. Within the mouth are two teeth, covered with a beautiful lip: with these the creatures bite fiercely when they are taken; but their bite is perfectly harmless.

These insects, beautiful as they are, are produced from eggs, which are deposited in the water,

water, where they remain for some time apparently without life or motion. They are ejected by the female into the water in clusters, like a bunch of grapes, where they sink to the bottom by their natural weight, and continue in that state till the young ones find strength enough to break the shell, and to separate from each other. The form in which they first shew life is that of a worm with six legs, bearing a strong resemblance to the dragon-fly in its winged state, except that the wings are yet concealed within a sheath peculiar to this animal. The rudiments of these appear in bunches on the back, within which the wings are folded up into each other, while all the colours and varieties of painting appear transparent through the skin. These animals, upon quitting the egg, still continue in the water, where they creep and swim, but do not move swiftly. They have likewise a sharp sight, and immediately sink to the bottom, if any one come to the places where they live, or whenever they perceive the least uncommon object. Their food at that time is soft mud and the glutinous earthy substances that are found at the bottom.

When

When these animals prepare to change from their reptile to their flying state, they then move out of the water to a dry place; into grass for example, pieces of wood, stone, or any thing else they meet with. There they firmly fix their acute claws; and, for a short time, continue quite immoveable. It is then observed, that the skin first opens on the head and back; and out of this opening they exhibit their real head and eyes, and at length their six legs; whilst, in the mean time, the hollow and empty skin, or slough of their legs, remains firmly fixed in its place. After this, the creature creeps forward by degrees; and by this means draws first its wings and then its body out of the skin; and proceeding a little farther, sits at rest for some time, as if immoveable. During this time the wings, which were moist and folded, begin by degrees to expand themselves, and to make smooth and even all those plaits which were laid against each other, like a closed fan. The body is likewise insensibly extended, until all the limbs have obtained their proper size and dimensions. It cannot at first make use of its new wings, and is therefore obliged to stay in the same place until its limbs are dried by the circumambient air; that being effected it takes wing, and
instead

instead of creeping at the bottom of a brook, it soars into the airy regions.

As this insect haunts and seeks after its food while flying in the air, Nature has provided it with two large eyes, which make almost the whole head, and which resemble glittering mother-of-pearl. It has also four expansive silver-coloured wings, with which it can turn itself with prodigious velocity, and to assist these it is furnished with a very long body, which, like a rudder, directs its motions. As the wings are long and the legs short, they seldom walk, but are constantly seen either resting or flying: for this reason they always choose dry branches of trees or shrubs to remain on, where they stay but a little time, being soon refreshed, and then again renew their flight.

Thus they are seen, adorning the summer with a profusion of beauty, lightly traversing the air in a thousand directions, and expanding the most beautiful colours to the sun. The garden, the forest, the hedges, and the rivulets, are animated by their sports; and there are few who have been brought up in the country, who have not employed a part of their childhood in pursuit of them.

But while these beautiful flies appear to us so idly and innocently employed, they are, in fact, the greatest tyrants of the insect tribe; and, like the hawk among birds, are only hovering up and down to seize their prey. They are the strongest and most courageous of all winged insects; nor is there one, that they will not attack and devour however large it may be. The blue fly, the bee, the wasp, and the hornet, form their constant prey; and even the butterfly, that spreads so large a wing, is often caught and treated without mercy. Their appetite seems to know no bounds; they spend the whole day in the pursuit, and have been seen to devour three times their own size in the capture of a single hour. They seize their prey flying, with their six claws, and tear it easily to pieces with their teeth, which are capable of inflicting troublesome wounds.

The males are exceedingly salacious and seek the females with great ardour; and no sooner does one appear than two or three males are seen pursuing and endeavouring to seize her with all their arts and agility. The instrument of generation in the male is placed very different from that of any other insect, being immediately

diately under the breast, and therefore seems as if incapable of being united to the sexual part of the female, which lies in the tail. His method of proceeding is this; as soon as he finds himself sufficiently near the female he seizes upon the back of her head, and fastening his claws upon her, turns round his forky tail, which he fastens round her neck, and in this manner fixes himself so firmly that no efforts can remove him; her endeavours are all in vain, and he often continues in this situation for three or four hours before she gives her consent. When he flies she is obliged to fly with him, but though she moves her wings he continues to direct the way; at length, as it were by the continuance of her restraint, she seems to comply, for turning up the end of her tail under his breast both instruments meet, and the eggs of the female receive the necessary fecundation. An hour or two after this she flies to some neighbouring pool, where she deposits her eggs; after exclusion they remain in a reptile state for a year, and then are changed into a beautiful fly, resembling the parent.

The *Lion-Ant*. Although this animal properly belongs to no order of insects, yet, as it

is changed into a fly very much resembling that which has just been described it may not be improper to give its history here.

The lion-ant, in its reptile state, is of the size of a common wood-louse, but somewhat broader. It has rather a longer head, and a roundish body, which becomes a little narrower towards the tail. The colour is a dirty grey, speckled with black, and the body is composed of several flat rings, which slip one upon another. It has six feet, four of which are fixed to the breast, and two to the neck. The head is small and flat, and before there are two little smooth horns, or feelers, which are hard, about a quarter of an inch long, and crooked at the ends. At the basis of the feelers there are two small black lively eyes, by which it can see the smallest object, as is easily discovered by its starting from every thing that approaches.

To a form so unpromising, and so ill provided for the purposes of rapacity, this animal unites the most ravenous appetites in nature; but to mark its imbecility still stronger, as other animals have wings or feet to enable them to advance towards their prey, the lion-ant is unprovided with such assistance from either. It has legs, indeed; but these only enable it to run backward

backward, and therefore incapable of making the smallest progressive motion. Thus, famished and rapacious as it ever seems, its prey must come to it, or rather into the snare provided for it, or the insidious assassin must starve.

But Nature, that has denied it strength or swiftness, has given it an equivalent in cunning, so that no animal fares more sumptuously, without ever stirring from its retreat. For this purpose, it chooses a dry sandy place, at the foot of a wall, or under some shelter, in order to preserve its machinations from the rain. The driest and most sandy spot is the most proper for it; because a heavy clogged earth would defeat its labour. When it goes about to dig the hole where it takes its prey, it begins to bend the hinder part of its body, which is pointed, and thus works backward; making, after several attempts, a circular furrow, which serves to mark out the size of the hole it intends making. Within this first furrow it digs a second, then a third, and afterwards others, which are always less than the preceeding. Then it begins to deepen its hole, sinking lower and lower into the sand, which it throws with its horns, or feelers, towards the edges. Thus, by repeating its labours all round, the sand is thrown up in a circle

cle about the edge of the pit, until the whole is quite completed. This hole is always formed in a perfect circle; and the pit itself resembles the inside of an inverted funnel; and when they are at their full growth they generally make their pit about two inches deep, and at the top as much in diameter.

The work being thus, with great labour, finished, the insidious insect places itself in ambush, hiding itself in the bottom under the sand in such a manner, that its two horns encircle the bottom of the pit. All the sides of this pit-fall are made of the loose and crumbling materials; so that scarcely any insect can climb up that has once got down to the bottom. Conscious of this, the lion-ant remains in patient expectation, ready to profit by that accident which throws some heedless little animal into his den. If then, by misfortune, an ant, a woodlouse, or a small caterpillar, walk too near the edge of the precipice, the sand gives way beneath them, and they fall to the bottom of the pit, where they meet inevitable destruction. The fall of a single grain of sand gives the murderer notice at the bottom of its cave; and it never fails to sally forth to seize upon its prey. It happens sometimes, however, that the ant, or the

the wood-louse is too nimble, and runs up the sides of the pit-fall before the other is ready to seize it. The lion-ant has then another contrivance; still more wonderful than the former; for, by means of its broad head and feelers, it has a method of throwing up a shower of sand, which falling upon the struggling captive, crushes it again to the bottom.

When the insect has once fallen thus low, no efforts can retrieve or release it; the lion-ant seizes it with its feelers, which are hollow, and darting them both into its body, sucks out all the little animal's juices with the utmost rapacity. The prey being reduced to a husk, the next care of the murderer is to remove the body from its cell; seemingly as if fearful that the appearance of dead carcasses should caution others of the danger of the place; taking, therefore, the wasted trunk up with its feelers, it throws it with wonderful strength, at least six inches from the edge of its hole, and then patiently sets about mending the injuries its fortifications may have received during the engagement. Nothing can abate the industry, vigilance, patience, or rapacity of this little animal; it will work for a week together to make its pit-fall; it will continue upon the watch for more than a month,

a month, patiently expecting the approach of its prey, and if a second happen to fall in before it has devoured the first, it will leave the half eaten one to attack the other. Though so voracious, it is surprisingly patient of hunger, some of them having been kept in a box with sand for upwards of six months without any kind of food.

When arrived at the age in which it is to change into another form, it then leaves off its usual rapacious habits, but preserves its industry. It no longer continues to make pits, but furrows up the land all round in an irregular manner; testifying those workings and violent agitations which most insects exhibit previously to their transformation. These animals are produced in autumn; they generally live a year, or as some think, two, before they assume a winged form; certain it is that they are found at the end of winter of all sizes, and the smaller kinds do not appear as if they had obtained sufficient maturity for transformation.

When the time of change approaches, if the insect find its little cell convenient, it seeks no other: if it be obliged to remove, after furrowing up the sand, it entirely conceals itself. It there spins a web, in the manner of the spider;

spider; which being made of a glutinous substance, and being humid from the moisture of its body, sticks to the little particles of sand among which it is spun; and in proportion as it is thus excluded, the insect rolls up its web, sand and all, into a little ball, the centre of which is formed by itself. This ball is about half an inch in diameter; and within it, the insect resides, in an apartment sufficiently spacious for all its motions. The outside is composed of sand and silk; the inside is lined with silk only, of a fine pearl colour, extremely delicate and perfectly beautiful. But though the work is so curious within, it appears externally nothing more than a lump of sand; and thus escapes the search of birds, that might otherwise disturb the inhabitant within.

The insect continues thus shut up for six weeks or two months; and gradually parts with its eyes, its feelers, its feet, and its skin; all which are thrust into the corner of the inner apartment, like a rag. The insect then appears almost in its winged state, except that there is a thin skin which wraps up the wings, and which appears to be nothing else but a liquor dried on the outside. Still, however, the little animal is too delicate and tender to venture

from its retreat, but continues enclosed for some time longer : at length, when the members of this new insect have acquired the necessary consistency and vigour, it tears open its lodging, and breaks through its wall. For this purpose, it has two teeth, like those of grasshoppers, with which it eats through, and enlarges the opening, till it gets out. Its body, which is turned like a screw, takes up no more than the space of a quarter of an inch ; but when it is unfolded, it becomes half an inch in length ; while its wings, that seemed to occupy the smallest space, in two minutes time unfold, and become longer than the body. In short, it becomes a large and beautiful fly, of the *libellula* kind, with a long and slender body, of a brown colour ; a small head, with large bright eyes, long slender legs, and four large, transparent, reticulated wings. The rest of its habits resemble that insect whose form it bears ; except, that instead of dropping its eggs in the water, it deposits them in sand, where they are soon hatched into that rapacious insect, so justly admired for its method of entrapping and catching its prey.

The

The *Grasshopper*, the *Locust*, the *Cicada*, the *Cricket* and the *Mole Cricket*, form a tribe of little animals, which, though they differ in size and colour, perfectly resemble each other in figure, appetites, nature, and transformation. Their differences, however, are sufficiently strong to render each family easily distinguishable, and they are held in a very different degree of estimation by mankind, some being considered as harmless, amusing insects, while others are condemned as the most destructive animals in nature: but possibly, as an ingenious author remarks, “if these animals be separately considered, the devouring locust is not in the least more mischievous than the musical grasshopper; the only difference is, that one species comes for food in a swarm, the other feeds singly.” In shape, size, and colour, they differ most materially; for some are green, some black, some livid, and some variegated; but many of them do not shew all their colours till they fly. Some have long legs, others short; some have many joints in them, and others but few. Some chirrup, others are mute. Some do little or no damage to the husbandman, while others in a single night, render a beautiful plain a dreary waste.

Of this variegated tribe, the *little grass-hopper* that breeds in such plenty in every meadow, and that continues its chirping through the summer, is best known to us; and, by perusing its history, we shall be in some measure acquainted with that of all the rest. This animal is of the colour of green leaves, except a little of brown which streaks the back, and two pale lines under the belly, and behind the legs. It may be divided into the head, the corselet, and the belly. The head is oblong, looking towards the earth, and bearing some resemblance to that of a horse. Its mouth is covered by a kind of round buckler jutting over it, and armed with teeth of a brown colour, hooked at the points. Within the mouth is preceivable a large reddish tongue, which is fixed to the lower jaw. The feelers, or horns, are very long, tapering off to a point; and the eyes are like two black specks, a little prominent. The corselet is elevated, narrow, armed above and below, by two serrated spines. The back is armed with a strong buckler, to which the muscles of the legs are firmly bound, and round these muscles are seen the vessels by which the animal breathes, as white as snow. The last pair of legs is much longer and stronger than the first two pair, fortified by

thick muscles, and very well formed for leaping. It has four wings; the anterior ones springing from the second pair of legs; the posterior from the third pair. The hinder wings are much finer, and more expansive, than the foremost, and are the principal instruments of its flight. The belly is very large, composed of eight rings, and terminated by a forked tail, covered with down, like the tail of a rat. When examined internally, besides the gullet, we discover a small stomach; and behind that a very large one, wrinkled and furrowed within side: lower down there is still a third: so that it is not without reason, that all the animals of this order are said to chew the cud, as they so much resemble ruminant animals in their internal conformation.

A short time after the grasshopper assumes its wings, it fills the meadow with its note; which, like that among birds, is a call to courtship. The male only of this tribe is vocal: and upon examining at the base of the wings, there will be found a little hole in its body, covered with a fine transparent membrane. This is thought by Linnaeus, to be the instrument it employs in singing; but others are of opinion, the sound is produced
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by rubbing its hinder legs against each other: however this may be, the note of one male is seldom heard, but it is returned by another; and the two little animals, after many mutual insults of this kind, are seen to meet and fight desperately. The female is generally the reward of victory: for, after the combat, the male seizes her with his teeth behind the neck, and thus keeps her for several hours.

Towards the latter end of autumn, the female prepares to deposit her burthen; and her body is then seen greatly distended with her eggs, which she carries to the number of a hundred and fifty. In order to make a proper lodgment in the earth for them, Nature has furnished her with an instrument at her tail, somewhat resembling a two-edged sword, which she can sheath and unsheath at pleasure: with this she pierces the earth as deep as she is able; and into the hole which her instrument has made, she deposits her eggs, one after the other.

Having thus provided for the continuation of her posterity, the animal herself does not long survive; but as the winter approaches, she dries up, seems to feel the effects of age, and dies from a total decay. Some, however, assert,

assert, that she is killed by the cold; and others that she is eaten by worms; but certain it is, that neither the male nor female are ever seen to survive the winter. In the mean time, the eggs which have been deposited continue unaltered, either by the severity of the season, or the retardation of the spring. They are of an oval figure, white, and of the consistence of horn: their size nearly equals that of a grain of anise; they are enveloped in the body within a covering, branched all over with veins and arteries; and when excluded, they crack, on being pressed between the fingers: their substance within is a whitish, viscous, and transparent fluid.

Generally, about the beginning of May, every egg produces an insect, about the size of a flea; these, at first are of a whitish colour; at the end of two or three days they turn black; and soon after they become of a reddish brown. They appear, from the beginning, like grasshoppers, wanting wings; and hop among the grass, as soon as excluded, with great agility.

Yet still they are by no means arrived at their state of full perfection; although they bear a strong resemblance to the animal in its perfect form. They want, or seem to want, the wings
which

which they are at last seen to assume; and can only hop among the grass, without being able to fly. The wings, however, are not wanting, but are concealed within four little bunches, that seem to deform the sides of the animal: there they lie rolled up in a most curious manner; and occupying a smaller space than one could conceive. Indeed, all insects, whatever transmutations they seem to undergo, are yet brought forth with those very limbs, parts, and wings, which they afterwards seem to acquire.

The grasshopper, which, for above twenty days after its exclusion, has continued without the use of its wings, that were folded up to its body, at length prepares for its emancipation, and for a life of greater liberty and pleasure. To make the proper dispositions for the approaching change, it ceases from its grassy food, and seeks about for a convenient place, beneath some thorn or thistle, that may protect it from an accidental shower.

At length, the skin, covering the head and breast, is seen dividing above the neck; the head issues out first from the bursting skin; the efforts still continuing, the other parts follow successively; so that the little animal

nal, with its long feelers, legs and all, works its way from the old skin, that remains fixed to the thistle, or the thorn. It is, indeed, inconceivable how the insect can thus extricate itself from so exact a sheath as that which covered every part of its body.

The grasshopper thus disengaged from its outer skin, appears in its perfect form; but it is so feeble, and its body so soft and tender, that it may be molded like wax. It is no longer of that obscure colour which it exhibited before, but a greenish white, which becomes more vivid as the moisture on the surface is dried away. Still, however, the animal shews no signs of life, but appears quite spent and fatigued with its labour for more than an hour together. During this time, the body is drying, and the wings unfolding to their greatest expansion; and the curious observer will perceive them, fold after fold, opening to the sun, till at last they become longer than the two hinder legs. The insect's body also is lengthened during this operation, and it becomes much more beautiful than before.

These insects are generally vocal in the midst of summer; and they are heard at sun-setting much louder than during the heat of the day.

They feed upon grass, and if their belly be pressed they are seen to return the juices of the plant which they last fed upon. Though unwilling to fly, and slow in flight, particularly when the weather is moist or cool, they are sometimes seen to fly to considerable distances. If caught by one of the hinder legs, they instantly disengage themselves, by leaving the leg behind; this does not grow again, as is the case with the crab and spider species; and the loss of it also prevents them from flying; for being unable to spring into the air, they have not room for the expansion of their wings. If handled roughly, they will bite very fiercely; and when they fly they make a noise with their wings. They generally keep in the low lands, where the grass is luxuriant, and the ground rich and fertile; there they deposit their eggs, particularly in those cracks which are formed by the heat of the sun.

The *Locust* differs from the above only in size, in rapidity of flight, and the powers of injuring mankind. The quantity of grass which a few grasshoppers that sport in the fields can destroy must be trifling; but when a swarm of locusts, two or three miles long, and several yards

yards deep, settle in a country, their devastations are dreadful. They seldom visit Europe in such dangerous swarms, yet in some of the southern kingdoms they appear very formidable. Those which have, at intervals, visited Europe, are supposed to have come from Africa, and are called the Great Brown Locust. This insect is about three inches long, and has two horns, or feelers, an inch in length. The head and horns are of a brownish colour; it is blue about the mouth, and also on the inside of the larger legs: the shield that covers the back is greenish; the upper side of the body brown, spotted with black, and the under side purple: the upper wings are brown, with small dusky spots, and one larger at the tips; the under wings are more transparent, and of a light brown tinged with green, with a dark cloud of spots near the tips.

There is no animal in the creation which multiplies so fast as these, if the sun be warm, and the soil in which their eggs are deposited dry. But damp climates are so contrary to their nature, that so far from encreasing they can barely exist.

The Scripture, which was written in a country where the locust made a distinguished fea-

ture in the picture of Nature, has given us several very striking images of this animal's numbers and rapacity. It compares an army where the numbers are almost infinite, to a swarm of locusts: it describes them as rising out of the earth, where they are produced: as pursuing a settled march to destroy the fruits of the earth, to co-operate with divine indignation.

It is confidently asserted that when locusts take the field they have a leader at their head, whose course they observe, and pay a strict attention to all his motions. They appear at a distance like a black cloud, which, as it approaches, gathers upon the horizon, and almost hides the light of day. In this manner they sometimes proceed to a considerable distance, but wretched is the district upon which they settle: they ravage the meadow and the pasture ground; strip the trees of their leaves, and the garden of its beauty; their visitation for a few minutes destroys the expectations of a year; and a famine but too frequently ensues. In their native tropical climates they are not so dreadful, as when they come into the southern parts of Europe; for there, though the plain and the forest be stripped of their verdure, the power of vegetation is so great that an interval
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of three or four days repairs the calamity; but our verdure is the livery of a season, and, if destroyed, we must wait till the ensuing spring repairs the damage. Besides, in their long flights to this part of the world, they are famished by the length of their journey, and are therefore more voracious wherever they happen to settle. But it is not by what they devour that they do so much damage as by what they destroy. Their very bite is thought to contaminate the plant, and to prevent its vegetation. To use the phrase of the husbandman, they burn whatever they touch, and leave the marks of their devastation for two or three years. But if they are noxious while living, they are still more so when dead; for wherever they fall they infect the air in such a manner, that the smell is insupportable.

Orosius tells us, that in the year of the world 3800, there was an incredible number of locusts infected Africa; and, that after having eaten up every thing that was green, they flew off, and were drowned in the African sea, where their stench was so great as almost to infect the air. In the year 1690, a cloud of locusts were seen to enter Russia, and thence to spread themselves over Poland and Lithuania, in such astonishing

nishing multitudes, that the air was darkened and the earth covered with them. In some places they were seen lying dead, heaped upon each other, four feet deep; in others they covered the surface like a black cloth; the trees bent beneath their weight; and the damage which the country sustained exceeded computation. In Barbary their numbers are formidable, and their visits are frequent. Dr. Shaw gives an account of their devastations in that country in the year 1724, to which he was a witness. Their first appearance was about the latter end of March, when the wind had been southerly for some time. In the beginning of April their numbers were so greatly encreased that, in the heat of the day, they formed themselves into large swarms, which appeared like clouds and darkened the sun. In the middle of May they began to disappear, retiring into the plains to deposit their eggs. In June the young brood began to make their appearance, forming many compact bodies of several yards square; which afterwards, marching forward, climbed the trees, walls, and houses, eating every thing that was green in their way. The inhabitants, to stop their progress, laid trenches all over their fields and gardens, filling them with water.

ter. Some placed large quantities of heath, stubble, and such like combustible matter, in rows, and set them on fire, on the approach of the locusts; but all this was to no purpose, for the trenches were quickly filled up, and the fires put out by the vast number of swarms that succeeded each other. A day or two after one of these was in motion, others that were just hatched came to glean after them, gnawing off the young branches, and the very bark of the trees. Having lived near a month in this manner, they arrived at their full growth, and threw off their worm-like state, by casting their skins. To prepare themselves for this change, they fixed their hinder feet to some bush or twig, or corner of a stone, when immediately, by an undulating motion, their heads would first appear, and soon after the rest of their bodies. The whole transformation was performed in seven or eight minutes; after which they were a little while in a languishing condition, but as soon as the sun and air had hardened their wings, and dried the moisture that remained after casting off their sloughs, they returned again to their former greediness, with an addition both of strength and agility. But they did not continue long in this state before they were entirely dispersed;

dispersed; after laying their eggs they directed their course northward, and probably perished in the sea. It is said that the holes these animals make to deposit their eggs are four feet deep in the ground; each lays about fourscore eggs, which are about the size of carraway comfits, and bundled up together in clusters.

In some parts of the world, the inhabitants turn, what seems a plague, to their own advantage. Locusts are eaten by the natives in many kingdoms of the east, and are caught in small nets provided for that purpose. They parch these insects over the fire in an earthen pan, and when their wings and legs are fallen off, they turn reddish, like boiled shrimps. Dampier says he has eaten them, thus prepared, and they are a tolerable dish. The natives of Barbary also eat them fried with salt, and they are said to taste like cray-fish. Vaillant also, in his Travels into the Interior part of Africa, in 1731, relates that his Hottentot attendants were much delighted at the appearance of a swarm of locusts, which resembled a cloud; as these insects passed over their heads they caught them in great numbers, and eat them with much avidity; he too was induced to partake of them, but declares that he did not like them.

There

There is a locust in Tonquin, about the bigness of the top of a man's finger, and as long as the first joint. It breeds in the earth, in low grounds; and in the months of January and February, they issue thence in vast swarms. At first they can hardly fly, so that they often fall into the rivers in great numbers: however, the natives in these months are upon the watch and take them up in multitudes in small nets. They either eat them fresh, broiled on the coals, or pickle them for keeping. They are considered as a great delicacy in that part of the world, as well by the rich as the poor. In the countries where they are eaten, they are regularly brought to market, and sold like larks or quails are in Europe. They must have been a common food with the Jews, as Moses, in the book of Leviticus, permits them to eat four different kinds of this insect, which he takes care to specify.

Of all animals, however, of this noxious tribe, the *Great West Indian locust*, individually considered, is the most formidable. It is about the thickness of a goose-quill, and the body is divided into nine or ten joints, in the whole about six or seven inches long. It has two small eyes, standing out of the head like those

of crabs, and two feelers like long hair. The whole body is studded with small excrescences, which are not much bigger than the points of pins. The shape is roundish, and the body diminishes in circumference to the tail, which is forked into two horns. Between these, there is a sort of a sheath, containing a small dangerous sting. If any person happen to touch this insect, he is sure to be stung; and is immediately taken with a shivering and trembling all over the body; which, however may soon be put a stop to, by rubbing the place that was affected with a little palm oil.

The *Cricket* is a very inoffensive animal. Though there is a species of this insect that lives entirely in the woods and fields, yet that with which we are best acquainted is the *House Cricket* whose voice is so well known behind a country fire in the winter's evening.

This insect very much resembles the grasshopper in its shape, its manner of ruminating, its voice, its leaping, and methods of propagating. It differs in its colour, which is uniformly of a rusty brown; in its food, which is more various; and in its place of residence, which is most usually in the warmest chinks behind a country

country hearth. The smallest chink serves to give them shelter; and where they once make their abode they are sure to propagate. They are of a most chilly nature, seldom leaving the fire-side; and, if undisturbed, are seen to hop from their retreats to chirrup at the blaze in the chimney. The wood-cricket is the most timorous animal in nature; but the chimney-cricket, being used to noises, disregards them.

Whether the voice of this animal is formed in the same manner with that of the grasshopper is not yet ascertained; nor do we well know the use of this voice, since anatomical inspection has not been able to discover the smallest organs of hearing. Certain it is, however, that they can distinguish sounds, since they are often heard to call, and this call is regularly answered by another, although none but the males are vocal.

As the cricket lives chiefly in the dark, so its eyes seem forward for the gloominess of its abode; and those who would surprise it, have only to light a candle unexpectedly; by which it is dazzled, and cannot find the way back to its retreat. It is a very voracious little animal, and will eat bread, flour, and meat; but it is parti-

cularly fond of sugar. They never drink, but keep for months together at the back of the chimney, where they cannot possibly have any moisture. They never cease chirruping but when affected by cold.

The great Scaliger was particularly delighted with the chirruping of crickets, and kept several of them for his amusement, enclosed in a box, which he placed in a warm situation. Others, on the contrary, think there is something ominous and melancholy in the sound, and use every endeavour to banish this insect from their houses.

Ledelius tells us of a woman who was very much incommoded by crickets, and tried, but in vain, every method of banishing them from her house. She at last accidentally succeeded; for having one day invited several guests to her house, where there was a wedding, in order to increase the festivity of the entertainment, she procured drums and trumpets to entertain them. The noise of these was so much greater than what the little animals were used to, that they instantly forsook their situation, and were never heard in that mansion more.

But of all this kind, the *Mole Cricket* is the most extraordinary. This animal is the largest
of

of all the insects with which we are acquainted in this country, being two inches and an half in length, and three quarters of an inch in breadth. The colour is of a dusty brown; and, at the extremity of the tail, there are two hairy excrescences, resembling in some degree, the tail of a mouse. The body consists of eight scaly joints, or separate folds, is brown on the upper parts, and more deeply tinged below. The wings are long, and narrow, and terminate in a sharp point, each having a blackish line running down it: however, when they are extended, they appear to be much broader than could, at first sight, be supposed. The shield of the breast is of a firm texture, of a blackish colour, and hairy. The fore-feet, which are this animal's principal instruments of burrowing in the earth, are strong, webbed, and hairy; it generally, however, runs backwards, but it is commonly under ground, where it burrows even faster than a mole. It is thought also to be amphibious; and capable of living under water, as well as under ground. Its legs are formed in such a manner, that it can penetrate the earth in every direction; before, behind, and above it. At night, it ventures from its subterraneous habitation, and, like the cricket

cricket, has its chirping call. When the female is fecundated, she makes a cell of clammy earth, in which she lays her eggs; the whole nest is about the size of a hen's egg, closed up on every side, and well defended from the smallest breath of air: she generally lays about 150 eggs, which are white, and about the size of a carraway comfit; and by thus enclosing them, they are secured from the depredations of the black beetle, who would otherwise destroy them. Nothing can exceed the care and assiduity which these animals exhibit in the preservation of their young. Wherever the nest is placed, there seems to be a fortification, avenues, and entrenchments, drawn round it: there are numberless winding ways that lead to it, and a ditch drawn about it, which few of its insect enemies are able to pass. But their care is not confined to this alone; for, at the approach of winter, they carry their nest entirely away, and sink it deeper in the ground, so that the frost can have no influence in retarding the young brood from coming to maturity. As the weather grows milder, they raise their magazine in proportion; till, at last they bring it as near the surface as they can, to receive the genial influence of the sun, without wholly exposing

exposing it to view; yet, should the frost unexpectedly return, they sink it again as before.

Of all this classes of insects, the *Earwig* undergoes the least change of any. This animal is so common, that it scarcely needs a description: its swiftness, in the reptile state, is not less remarkable than its indefatigable velocity when upon the wing. That it must be very prolific, appears from its numbers; and that it is very harmless, every one's experience can readily testify. It is provided with six feet, and two feelers: the tail is forked; and with this it often attempts to defend itself against every assailant. But its attempts are only the threats of impotence; they draw down the resentment of powerful animals, but no way serve to defend it. By prejudice it is almost universally supposed to enter into the ears of people sleeping; thus causing madness, from the intolerable pain, and soon after death itself; but such calumny is entirely groundless; and it were well if the accusations which gardeners bring against the earwig were as slightly founded. There is nothing more certain, than that it lives among flowers, and destroys them. When fruit also has been wounded by flies, the earwig generally

rally comes in for a second feast, and sucks those juices which they first began to broach. Still, however, this insect is not so noxious as it would seem; and it is seldom found but where the mischief has been originally begun by others. Like all of this class, the earwig is hatched from an egg. As there are various kinds of this animal, so they choose different places to breed in: in general, however, they lay their eggs under the bark of plants, or in the clefts of trees, when beginning to decay. They proceed from the egg in that reptile state in which they are most commonly seen; and as they grow larger, the wings that are bound under the skin begin to sprout. It is amazing how very little room four large wings take up before they are protruded. The sheath in which they are enveloped, folds and covers them so neatly, that the earwig seems quite destitute of wings; and even when they have burst from their confinement, the animal, by the power of the muscles and joints, which it has in the middle of its wings, can closely fold them into a very narrow compass. When the earwig has become a winged insect, it flies in pursuit of the female, ceasing to feed, and is wholly employed in the business of propagation. It lives, in its winged state, but a few days;
and

and, having taken care for the continuance of posterity, dries up, by degrees, and dies.

The *Cuckow Spit* or *Froth Worm*, is commonly found hidden in that frothy matter which is seen on the surface of plants. It has an oblong obtuse body, and a large head with small eyes. It has four wings: the external ones are of a dusky brown colour, marked with two white spots; the head is black. The spume in which it is found wallowing, is all of its own formation; it proceeds from the vent of the animal, and other parts of the body, and if it be wiped away it will quickly eject a new quantity. Within this spume it acquires four tubercles on its back, wherein the wings are enclosed: these bursting, from a reptile it becomes a winged insect; and thus having arrived at its perfect state, it flies abroad, for a short time, to meet its mate and propagate its kind.

The *Water Tipula* has an oblong, slender body, with four feet fixed upon the breast, and four feelers near the mouth. It has four weak wings, seemingly incapable of serving the purpose of flying; but to assist the animal in leaping,

and to run on the water, which it does with such wonderful lightness as scarcely to cause the slightest motion on the surface. This insect is generally seen sporting on the rivers, and about their banks, especially under shady trees, and commonly great numbers of them together.

The common *Water Fly* breeds in the same manner as the preceding of this class. This insect is sometimes called the *Notonecta*, because it does not swim, in the usual manner, upon its belly, but on its back; and which, indeed, seems to be highly necessary, since it feeds on the under side of plants which grow on the surface of the water; and it was therefore doubtless, thus formed with its mouth upwards to take its food with greater ease.

The *Water Scorpion* is a large insect, being nearly an inch in length, and about half an inch in breadth. Its body is nearly oval, but very flat and thin; its tail is long and pointed; its head is small, and the feelers appear like legs, resembling the claws of a scorpion, but without sharp points. This insect is generally found in ponds; it is extremely tyrannical and rapacious, and destroys twenty times as much as its hunger

requires. One of these being put into a bason of water in which were thirty or forty worms of the libellula kind, each as large as itself, it destroyed them all in a few minutes, getting on their backs and piercing through their bodies with its trunk. These animals, however, though so formidable to others, are themselves greatly over-run with a little kind of louse, about the size of a nit, which, to all appearance, repays the injury which they inflict upon others. These insects live in the water by day, out of which they rise in the dusk of the evening into the air, and so flying from place to place often betake themselves, in quest of food, to other waters. It remains in the place where it was produced, until its wings are grown, but when come to its state of perfection it sallies forth in search of a companion of the other sex, in order to continue its kind.

The *Ephemera*, though not strictly belonging, seems more properly referred to this rank than any other. Indeed, as we have had repeated occasion to observe, it is in vain to attempt exactness in a history where Nature seems to take delight in sporting with variety.

All ephemeræ, of which there are various kinds, are produced from the egg, in the form of worms; whence they change into a more perfect form, namely, that of aureliæ, which is a kind of middle state between a worm and a fly; and thence they take their last mutation, which is into a beautiful fly, of a longer or shorter duration according to its kind.

The ephemeræ, in its fly state, is a very beautiful winged insect, and has a strong similitude to the butterfly; but its wings differ, not being covered with the painted dust with which those of butterflies are adorned, and rendered opake, for they are very transparent and very thin. Those insects have four wings, the uppermost of which are much the largest; when it is at rest it generally lays its wings one over the other, on the back. The body is long, being formed of six rings, that are larger at the origin than near the extremity; and from this a tail proceeds that is longer than all the rest of the fly, and consists sometimes of three threads of an equal length, and sometimes of two long and one short one.

The reptile which is to become a fly, and which is granted so long a term, when compared to its latter duration, (living sometimes

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in the first state two or three years, and in the last scarcely as many hours) is an inhabitant of the water, and, in many particulars bears a strong resemblance to fish; having gills, by which it breathes at the bottom, and also the tapering form of aquatic animals. These insects have six scaly legs, fixed on the corselet. Their head is triangular; the eyes are placed forwards and may be distinguished by their largeness and colour. The mouth is furnished with teeth; the body consists of six rings; that next the corselet being the largest, but growing less and less to the end: the last ring is the shortest, and from which the three threads proceed, which are as long as the whole body.

As there are several kinds of this animal, their aurelias are consequently of different colours; some yellow, others brown, and others cream-coloured. Some of them perforate cells at the bottom of the water, from which they never stir out, but feed upon the mud that composes the walls of their habitation. Others range about, rise from the bottom to the surface, swim between two waters, quit that element entirely to feed upon plants by the river side, and then return to their favorite element for safety and protection.

When

When these reptiles are about to change into a fly state, the smooth and depressed form of the upper part of the body becomes more swollen and of a rounder shape. They are found in the greatest numbers along the banks of the Rhine, or the Seine, near Paris, where about sun-set, for three or four days in the middle of summer, they excite astonishment by their multiplicity. The thickest descent of flakes of snow in winter does not seem to equal their number; the whole air seems alive with the newborn race, and the earth itself is covered all over with their remains. With these the operation of change is performed with the greatest ease. The aurelias are scarcely lifted above the surface of the water, when their old sheathing skin bursts, and through the cavity which is thus formed a fly issues, whose wings, at the same instant are unfolded, and lift it into the air. Those that are yet beneath the surface of the water, wait only for the evening to begin their transformation; the most industrious shake off their old garments about eight o'clock, and those who are the most tardy are transformed before nine. Millions and millions of aurelias rise in this manner to the surface, and at once become flies, and fill every quarter with their flutterings.

flutterings. But all these sports are shortly to have an end; the little strangers live but an hour or two; in that short space the whole swarm falls to the ground, and covers the earth, like a deep snow for several hundred yards on each side of the river. They are of a most delicate nature; the slightest touch is fatal to them; if they even hit against each other they instantly die.

At this time the males and females are very differently employed. The males, quite inactive, and apparently without desires, seem only born to die: unlike those of other insects, they neither follow the opposite sex, nor bear any enmity to each other: after fluttering for an hour or two, they drop on the land, and conclude their existence. It is otherwise with the females: they have scarcely risen from the surface of the water, and dried their wings, but they hasten back again to deposit their eggs: if they happen to flutter upon land, they leave their burden in the place where they drop.

This appears to be one of, if not the most prolific of all insects; and it would seem that there was a necessity for such a supply, as in its reptile state, it is the favourite food of every kind of fresh-water fish. It is in vain that
these

these little animals form as it were galleries at the bottom of the river for their security, for many kinds of fish break in upon their retreats and thin their numbers. For this reason fishermen endeavour to provide themselves with these insects, as the most grateful bait to ensnare those whose rapacity leads them to seek the destruction of others.

But though, in general, these flies do not live above two or three hours at farthest, there are some few kinds which live several days, and one in particular, after quitting the water has another case or skin to get rid of. These are often seen in the fields and woods distant from the water; but they are more frequently found in its vicinity. They may also be discovered sticking upon walls and trees, and frequently with their head downwards, without changing place, or having any sensible motion. They are then waiting for the moment when they shall be divested of their last incommodious covering, which sometimes does not happen for two or three days, but they never move until it is effected.



Silk Worm in its different States.



Spiders.



Ants and Ant Hill.

OF INSECTS OF THE THIRD ORDER.

IN proceeding to describe this class, the *Caterpillars* naturally present themselves the first, and which may be easily distinguished from worms or maggots, by the number of their feet, and by their producing butterflies or moths. When the sun calls up vegetation, and vivifies the various eggs of insects, the caterpillars are the first that are seen, upon almost every vegetable and tree, eating its leaves, and preparing for a state of greater perfection. They have feet both before and behind ; which not only enable them to move forward by a sort of steps made by their fore and hinder parts, but also to climb up vegetables, and to stretch themselves out from the boughs and stalks, to reach their food at a distance. All of this class have from eight feet, at the least, to sixteen ; and this may serve to distinguish them from the worm tribe,

that never have so many. The animal into which they are converted, is always a butterfly or a moth; and these are always distinguished from other flies, by having their wings covered over with a painted dust, which gives them such various beauty.

It has been established by the united observations of several naturalists, that all caterpillars are hatched from the eggs of butterflies. When the caterpillar first bursts from its egg, it is small and feeble; its appetites are in proportion to its size, and it seems to make no great consumption; but as it encreases in magnitude, it improves in its appetites; so that, in its adult or caterpillar state, it is the most ravenous of all animals whatsoever. A single caterpillar will eat double its own weight of leaves in a day, and yet seem no way disordered by the meal.

The body of the caterpillar, when anatomically considered, is found to be composed of rings, whose circumference is pretty near circular or oval. They are generally twelve in number, and are all membraneous; by which caterpillars may be distinguished from many other insects, that nearly resemble them in form. The head of the caterpillar is connected to the first ring by the neck, which is generally so short
and

and contracted, that it is scarcely visible. All the covering of the head in caterpillars seems to consist of a shell; and they have neither upper nor under jaw, for they are both placed rather vertically, and each jaw armed with a large thick tooth, which is, singly, equal to a number. With these the animals devour their food in such amazing quantities; and, with these, some of the kind defend themselves against their enemies. Though the mouth be kept shut, the teeth are always uncovered; and, while the insect is in health, they are seldom without employment. Whatever the caterpillar devours, these teeth serve to chop into small pieces, and render the parts of the leaf fit for swallowing. Many kinds, while they are yet young, eat only the succulent part of the leaf, and leave all the fibres untouched; others, however, attack the whole leaf, and eat it clean away: some are seen eating the whole day; others have their hours of repast; some chuse the night, and others the day. When the caterpillar attacks a leaf, it places its body in such a manner, that the edge of the leaf shall fall between its feet, which keeps it steady, while the teeth are employed in cutting it: these fall upon the leaf, somewhat in the manner of a pair of gardener's

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sheers;

sheers; and every morsel is swallowed as soon as cut. Some caterpillars feed upon leaves so very narrow, that they are not broader than their mouths; in this case the animal is seen to devour it from the point.

As there are various kinds of caterpillars, so the number of their feet is various; some having eight, and some sixteen. Of these feet, the six foremost are covered with a sort of shining gristle; and therefore called the shelly legs. The hindmost feet, whatever be their number, are soft and flexible, and are called membraneous. Caterpillars also, with regard to their external figure, are either smooth or hairy. The skin of the first kind is soft to the touch, or hard, like shagreen; the skin of the latter is hairy, and, as it were thorny; and generally, if handled, stings like nettles.

Caterpillars, in general, have six small black spots, placed on the circumference of the fore-ring, and a little to the side of the head. Three of these are larger than the rest, and are convex and transparent: these Rheaumur takes to be the eyes of the caterpillar; yet, most of these reptiles have very little occasion for sight, and seem to be directed only by their feeling.

But the parts of the caterpillar's body which most justly demand our attention, are the *stigmata*, as they are called; or those holes on the sides of its body, through which the animal is supposed to breathe. These holes are easily discoverable all along on each side. They are eighteen in number, nine on a side, rather nearer the belly than the back; a hole for every ring, of which the animal's body is composed, except the second, the third, and the last. These oval openings may be considered as so many mouths, through which the insect breathes; but with this difference, that as we have but one pair of lungs, the caterpillar has no less than eighteen. These lungs appear to be hollow cartilaginous tubes, and of the colour of mother-of-pearl. These tubes are often seen to unite with each other; some are perceived to open into the intestines; and some go to different parts of the surface of the body. That these vessels serve to convey the air, appears evidently, from the well known experiment of Malpighi; who, by stopping up the mouths of the stigmata with oil, quickly suffocated the animal, which was seen to die convulsed the instant after. In order to ascertain his theory, he rubbed oil upon other parts of the

insect's

insect's body, leaving the stigmata free: and this seemed to have no effect upon the animal's health, but it continued to move and eat as usual: he rubbed oil on the stigmata of one side, and the animal underwent a partial convulsion, but recovered soon after. However, it ought to be observed, that air is not so necessary to these as to the nobler ranks of animals, since caterpillars will live in an exhausted receiver for several days together; and though they seem dead at the bottom, yet, when taken out, recover, and resume their former vivacity.

If the caterpillar be cut open longitudinally along the back, its intestines will be perceived running directly in a straight line from the mouth to the anus. They resemble a number of small bags opening into each other, and strengthened on both sides by which they are united. These insects are, upon many occasions, seen to cast forth the internal coat of their intestines with their food, in the changes which they so frequently undergo. But the intestines take up but a small part of the animal's body, if compared to the fatty substance in which they are involved. This substance changes its colour when the insect's metamorphosis

phosis begins to approach; and from white it is usually seen to become yellow. If to these parts we add the caterpillar's implements for spinning, (for all caterpillars spin at one time or other) we shall have a rude sketch of this animal's conformation.

The life of a caterpillar seems one continued succession of changes; and it throws off one skin only to assume another; and this for eight or ten times successively; but we must not, however, confound this changing of the skin with the great metamorphosis which it is afterwards to undergo, the one being the action of a minute, the other the most important event of their lives; and besides which, it is nothing more than what is common with almost the whole insect tribe. A day or two before the time of this operation approaches, the insect ceases to eat, loses its usual activity, and appears to remain immoveable. It retires to some place of supposed security, though it is no longer timorous but seems regardless even of the touch. It now and then bends itself, and elevates its back, and then stretches again to the utmost extent; it will lift up its head, but soon lets it fall again; it sometimes waves it three or four times

times from side to side, and then remains quiet; At length some of the wings of the body are seen to swell considerably, particularly the first and second; the old skin distends and bursts, till by repeated swellings and contractions, in every ring, the caterpillar disengages itself, and creeps from its inconvenient covering.

However laborious this operation may be, it is performed in the space of a minute; and the animal, having thrown off its old skin, seems to enjoy new vigour, as well as to have acquired colouring and beauty. Sometimes it happens that it takes a new appearance, and colours very different from the old. Those that are hairy, still preserve their covering, although their ancient skin seems not to have lost a single hair; every hair seems to have been drawn, like a sword from the scabbard. The fact, however, is, that a new crop of hair grows between the old skin and the new, and probably helps to throw off the external covering.

The caterpillar having, in this manner, continued for several days feeding, and at intervals casting its skin, begins at last to prepare for its change into an aurelia.

Preparatory to this important transmutation, the caterpillar most usually quits the plant, or the
tree

tree on which it fed; or at least attaches itself to the stalk, or the stem, more gladly than the leaves. It forsakes its food, and prepares, by fasting, to undergo its transmutation.

Those of them which are capable of spinning themselves a web, set about this operation; those which have already spun, await the change in the best manner they are able. The web, or cone, with which some cover themselves, hides the aurelia contained within from the view; but in others, where it is more transparent, the caterpillar, when it has done spinning, strikes in the claws of the two feet under the tail, and afterwards forces in the tail itself, by contracting those claws, and violently striking the feet one against the other. If, however, they be taken from their web at this time, they appear in a state of great languor; and, incapable of walking, remain on that spot where they are placed. In this condition they remain one or two days, preparing to change into an aurelia; somewhat in the manner they made preparations for changing their skin. They then appear with their bodies bent into a bow, which they now and then are seen to straiten: they make no use of their legs; but, if they attempt to change place, do it by the contortions of their body.

In proportion as their change into aurelia approaches, their body becomes more and more bent; while their extensions and convulsive contractions increase. The hinder end of the body is the part which the animal first disengages from its caterpillar skin; that part of the skin remains empty, while the body is drawn up contracted towards the head. In the same manner they disengage themselves from the two succeeding rings; so that the animal is then lodged entirely in the forepart of its caterpillar covering; that half which is abandoned remains flaccid and empty; while the fore part, on the contrary, is swollen and distended. The animal having thus quitted the hinder part of its skin, to drive itself up into the fore part, still continues to heave and work as before; so that the skin soon bursts into three pieces, and a longitudinal opening is made in the three first rings of the body, through which the insect thrusts forth its naked body, with strong efforts. Thus, at last, it entirely gets free of its caterpillar skin, and for ever forsakes its most odious reptile form.

The caterpillar, thus stripped of its skin for the last time, is now become an aurelia, in which the parts of the future butterfly are all visible;



Butterflies.



FIG. 126.



127.



128.



129.



130.



131.

sible; but in so soft a state, that the smallest touch can discompose them. The animal now becomes helpless and motionless.

Immediately after being stripped of its caterpillar skin, it is of a green colour, especially in those parts which are distended by an extraordinary afflux of animal moisture; but in ten or twelve hours after being thus exposed, its parts harden, and the air forms its external covering into a hard crust. From the beautiful and resplendent colour, with which it is thus sometimes adorned, some authors have called it a *chrysalis*, implying a creature made of gold.

The *butterfly* does not continue so long under the form of an *aurelia*, as one would be apt to imagine. In general, those caterpillars that provide themselves with cones, continue within them but a few days after the cone is completely finished. Some, however, remain buried in this artificial covering for eight or nine months, without taking the smallest sustenance during the whole time: and though in the caterpillar state no animals are more voracious, yet when thus transformed, they appear a miracle of abstinence. In all, sooner or later, the butterfly bursts from its prison; not only that natural prison which is formed by the skin of the

N n 2 *aurelia*,

aurelia, but also from that artificial one of silk, or any other substance in which it has enclosed itself.

If the animal be shut up within a cone, the butterfly always gets rid of the natural internal skin of the aurelia, before it eats its way through the external covering which its own industry has formed round it. When this operation begins, there seems to be a violent agitation in the humours contained within the animal's body, though by no means so great as it experienced in changing from its caterpillar into its aurelia state. After some struggles, the skin bursts in four regular pieces; the skin of the head and legs first separates; then the skin at the back flies open, and, dividing into two regular portions, disengages the back and wings; then there likewise happens another rupture, in that portion which covered the rings of the back of the aurelia. After this, the butterfly, as if fatigued, remains very quiet for some time, with its wings pointed downwards, and its legs fixed in the skin which it had just thrown off. At first sight, the animal, just permitted the use of its wings, seems to want them entirely: they take up such little room, that one would wonder where they were hidden. But

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soon after, they expand so rapidly, that the eye can scarcely attend their unfolding, and almost in an instant appear five times longer than before.

Nor is it the wings alone that are thus increased : all their spots and paintings, before so minute as to be scarcely discernible, are proportionably extended ; so that, what a few minutes before seemed only a number of confused, unmeaning points, now become distinct and most beautiful ornaments.

The wing, at the instant it is freed from its confinement, is considerably thicker than afterwards ; so that it spreads in all its dimensions, growing thinner as it becomes broader. If one of the wings be plucked from the animal just set free, it may be spread by the finger, and it will soon become as broad as the other, which has been left behind. As the wings extend themselves so suddenly, they have not yet had time to dry ; and accordingly appear like pieces of wet paper, soft, and full of wrinkles. In about half an hour, they are perfectly dry, their wrinkles entirely disappear, and the little animal assumes all its splendor. Those which are enclosed within a cone find their emancipation somewhat more difficult, as they have another

ther prison to break through; but this they perform in a short time; for the butterfly, freed from its aurelia skin butts with its head against the walls of its artificial prison; thus it soon forces its way through, and in less than a quarter of an hour acquires its full perfection.

The number of these beautiful animals is very great; and though Linnæus has reckoned up above seven hundred and sixty different kinds, the catalogue is still very incomplete. Every collector of butterflies can shew undescribed species; and such as are fond of minute discovery, can here produce animals that have been examined only by himself. In general, however, those of the warmer climates are larger and more beautiful than such as are bred in this country.

The wings of butterflies are very different from those of any other fly: they have four in number, and though two of them be cut off, the animal is still enabled to fly. They are, in their own substance, transparent, but owe their opacity to the beautiful dust with which they are covered. The wing of the butterfly being observed with a good microscope, it will be seen to be studded over with a variety of little grains,
of

of different forms and dimensions, generally supported upon a footstalk regularly laid upon the whole surface. The wing itself is composed of several membranes, which render the construction very strong, though light; and though it is covered over with thousands of those scales, or studs, yet its weight is very little increased by the number, and the animal is enabled to support itself for a considerable time in the air.

The butterfly may be said to consist of three parts; the head, the corselet, and the body. The body is the hinder part, and is composed of rings, which are generally concealed under long hairs with which that part of the animal is clothed. The corselet is more solid than the rest of the body, and in which the fore wings, and the legs are fixed. They have six legs but only make use of four; the two fore are covered by the long hairs of the body, and are sometimes so much concealed that it is difficult to discover them. The eyes of butterflies have not all the same form; in some they are the larger portion of a sphere, in others they are but a small part of it, and just appearing from the head; in some also they are small, and in others large; but in all of them

the outward coat has a lustre, in which may be discovered all the various colours in the rainbow. It has, likewise the appearance of a multiplying glass, having a great number of sides, or facets, in the manner of a brilliant cut diamond. In this particular, the eye of the butterfly and of most other insects correspond, and Leuwenhoek pretends there are above 6000 facets in the cornea of a flea. Puget adapted the cornea of a flea in such a position, as to see objects through it by the means of a microscope, and nothing, he says, could exceed the strangeness of its representations: a soldier, who was seen through it, appeared like an army of pigmies; for while it multiplied, it also diminished the object: the arch of a bridge exhibited a spectacle more magnificent than human skill could perform: the flame of a candle seemed a beautiful illumination. It still, however, remains a doubt, whether the insect see objects singly, as with one eye, or whether every facet is itself a complete eye, exhibiting, its own object distinct from all the rest.

Butterflies, as well as most other flying insects, have two instruments, like horns, on their heads, called feelers. These are moveable at the base, and have a number of joints,
by



FIG. 132.



133.



134.



135.



136.



137.



138.

Drones.



139.

Wasps.



140.



141.



142.

Hornets.



143.



144.



145.

by which means the insect is enabled to turn them in every direction. Those of the butterfly are placed at the top of the head, pretty near to the external edge of each eye. Of what benefit they are to the animal cannot be exactly ascertained, and all that has hitherto been said is mere conjecture. Directly between the eyes, most of the butterfly kind have a trunk, which, when the animal is not seeking its nourishment is rolled up like a curl; but when in search of food, and the butterfly has settled upon some flower, then the trunk is thrust out and employed in searching the flower to the very bottom, let it be ever so deep. This search being repeated seven or eight times, the butterfly passes on to another. The trunk itself consists of two equal hollow tubes, nicely joined to each other.

This tribe of insects has been divided into *Diurnal* and *Nocturnal* Flies; or, as commonly called, *Butterflies* and *Moths*; from the one flying by day, and the other being usually on the wing during the night. They may be easily distinguished from each other by their horns, or feelers; those of the butterfly being clubbed, or knobbed at the end; those of the moth tapering to a point.

The butterflies, as well as the moths, employ the short life assigned them in a variety of enjoyments. Their whole time is spent either in quest of food, which every flower offers; or in pursuit of the female, whose approach they can often perceive at a very great distance. Their sagacity in this particular is not less astonishing than true; but by what sense they are thus capable of distinguishing each other at such distances is not easy to conceive. From whatever power it may arise, however, it is certain that the male may be often observed fluttering, and then taking wing, fly directly to a female who may be perched on a flower at two miles distance.

The general rule among insects is, that the female is larger than the male; and this obtains particularly in the tribe we are describing. The body of the male is more small and slender; that of the female more thick and oval. The eggs of the female butterflies are deposited in the body like a bed of chaplets; which, when excluded, are usually oval, and of a whitish colour: some, however, are quite round; and others flatted, like a turnip. The covering, or shell of the egg, though solid, is thin and transparent; and in proportion as the caterpillar grows within the
egg,

egg, the colours change, and are distributed differently. The butterfly seems very well instructed by Nature in its choice of the plant or the leaf, where it shall deposit its burthen. Each egg contains but one caterpillar; and it is requisite that this little animal, when excluded, should be near its peculiar provision. All the eggs of butterflies are attached to the leaves of their favourite plant, such as the rag-weed, the cabbage, or the nettle, by a sort of size or glue; where they continue, unobserved, unless carefully sought after. The eggs are sometimes placed round the tender shoots of plants, in the form of bracelets, consisting of above two hundred in each, and generally surrounding the shoot, like a ring upon a finger. Some butterflies secure their eggs from the injuries of air, by covering them with hair, plucked from their own bodies, as birds sometimes are seen to make their nests; so that their eggs are thus kept warm, and also entirely concealed. All the moth kind lay their eggs almost as soon as they quit their aurelia state, while many butterflies do not deposit them until the approach of winter; nay some conceal themselves in the hollows of trees till April, when they deposit their eggs and die.

Some of the caterpillar kind, that seem fitted to live only upon leaves and plants, will however, eat each other; and the strongest will devour the weak in preference to their vegetable food. That which lives upon the oak, is found to seize any of its companions, that it conveniently can, by the first rings, and inflict a deadly wound: it then feasts in tranquillity on its prey, and leaves nothing of the animal but the husk,

But it is not from each other that they have most to fear, as in general they are inoffensive; and many of this tribe are found to live in a sort of society. Many kinds of flies lay their eggs either upon, or within their bodies; and as these turn, into worms, the caterpillar is seen to nourish a set of intestine enemies within its body, that must shortly be its destruction: nature having taught flies, as well as all other animals, the surest methods of perpetuating their kind. "Towards the end of August," says Rheumur, "I preceived a little fly, of
 " a beautiful gold colour, busily employed in
 " the body of a large caterpillar, of that kind,
 " which feeds upon cabbage. I gently separated that part of the leaf on which these insects were placed, from the rest of the plant,
 " and

“ and placed it where I might observe them
“ more at my ease. The fly, wholly taken up
“ by the business in which it was employed,
“ walked along the caterpillar’s body, now and
“ then remaining fixed to a particular spot.
“ Upon this occasion I perceived it every now
“ and then dart a sting, which it carried at the
“ end of its tail, into the caterpillar’s body, and
“ then drew it out again, to repeat the same operation in another place. It was not difficult
“ for me to conjecture the business which engaged this animal so earnestly; its whole aim
“ was to deposit its eggs in the caterpillar’s
“ body; which was to serve as a proper retreat
“ for bringing them to perfection. The reptile thus rudely treated, seemed to bear all
“ very patiently, only moving a little when
“ stung too deeply; which, however, the fly
“ seemed entirely to disregard. I took particular care to feed this caterpillar; which
“ seemed to me to continue as voracious and
“ vigorous as any of the rest of its kind. In
“ about ten or twelve days, it changed into an
“ aurelia, which seemed gradually to decline,
“ and died; upon examining its internal parts,
“ the animal was entirely devoured by worms,
“ which,

“ which, however, did not come to perfection,
“ as it is probable they had not enough to sus-
“ tain them within.”

What Rheumur perceived in this instance, may be daily observed in all the caterpillar kind, particularly in the large one that feeds on cabbages, which in some seasons it is difficult to find without being thus impregnated, especially by the ichneumon, and other flies who make a nest of their bodies, and carefully deposit their eggs in them. But, laid in those parts that are not mortal, the reptile still continues to live, and to feed, shewing no sign of being incommoded by its new guests.

The Silk-worm. Though silk was anciently brought in small quantities to Rome, yet it was so scarce as to be sold for its weight in gold; and was considered as such a luxurious refinement in dress, that it was infamous for a man to appear in habits of which silk formed but half the composition. It was most probably brought among them from the remotest parts of the East, since it was, at the time of which we are speaking, scarcely known even in Persia.

The

The silkworm is a large caterpillar, of a whitish colour, with twelve feet, and producing a butterfly of the moth kind. There are two methods of breeding silk-worms; for they may be left to grow, and remain at liberty upon the trees where they are hatched; or they may be kept in a place built for that purpose, and fed every day with fresh leaves. The first method is used in China, Tonquin, and other hot countries; but to breed them in Europe, they must be sheltered and protected from every external injury. For this purpose, a room is chosen, with a south aspect; and the windows are so well glazed, as not to admit the least air; the walls are well built, and the planks of the floor exceedingly close, so as to admit neither birds nor mice, nor even so much as an insect. In the middle there should be four pillars erected, or four wooden posts, so placed as to form a pretty large square. Between these are different stories made of ozier hurdles; and under each hurdle there should be a floor, with an upright border all round. These hurdles and floors must hang upon pulleys, so as to be placed, or taken down at pleasure.

When the worms are hatched, some tender mulberry leaves are provided, and placed in the
cloth

cloth or paper box in which the eggs were laid, and which are large enough to hold a great number. When they have acquired some strength, they must be distributed on beds of mulberry leaves, in the different stories of the square in the middle of the room, round which a person may freely pass on every side. They will fix themselves to the leaves, and afterwards to the sticks of the hurdles, when the leaves are devoured. They then have a thread, by which they can suspend themselves on occasion, to prevent any shock by a fall. Care must be taken that fresh leaves be brought every morning, which must be strewed very gently and equally over them; when the silkworms will forsake the remainder of the old leaves, which must be carefully removed, and every thing left very clean; for nothing hurts these insects so much as moisture and uncleanness. For this reason, the leaves must be gathered when the weather is dry, and kept in a dry place, if it be necessary to lay in a store. As these animals have but a short time to live, they make use of every moment, and are almost continually spinning, except at those intervals when they change their skins. If mulberry leaves be difficult to be obtained, the leaves of lettuce,

lettuce, or holy oak, will sustain them: but they do not thrive so well as upon their own diet; and their silk will neither be so copious, nor of so good a quality.

Though a judicious choice and a careful management of their diet, is absolutely necessary, yet there is another precaution of equal importance, which is to give them air, and open their chamber windows, at those times when the sun shines warmest.

The worm, at the time it bursts the shell, is extremely small, and of a black colour; but the head is of a more shining black than the rest of the body: some days after they begin to turn whitish, or of an ash coloured grey. After the skin begins to grow too rigid, or the animal is stinted with it, the insect throws it off, and appears clothed a-new: it then becomes larger and much whiter, though it has a greenish cast. After some days, which are more or less, according to the different heat of the climate, or to the quality of the food, it leaves off eating, and seems to sleep for two days together: then it begins to stir, and puts itself into violent motions, till the skin falls off the second time, and is thrown aside by the animal's feet. All these changes are made in three weeks or a

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month's time; after which it begins to feed once more, still in its caterpillar form, but a good deal differing from itself before its change. In a few days time it seems to sleep again; and when it awakes, it again changes its clothing, and continues feeding as before. When it has thus taken a sufficiency of food, and its parts are disposed for assuming the aurelia form, the animal forsakes, for the last time, all food and society, and prepares itself a retreat to defend it from external injuries, while it is seemingly deprived of life and motion.

This retreat is no other than its cone, or ball of silk, which Nature has taught it to compose with great art; and within which it buries itself, till it assumes its winged form. This cone, or ball, is spun from two little longish kinds of bags that lie above the intestines, and are filled with a gummy fluid, of a marigold colour. This is the substance of which the threads are formed; and the little animal is furnished with a suprising apparatus for spinning it to the degree of fineness which its occasions may require. This instrument in some measure, resembles a wire drawer's machine, in which gold or silver threads are drawn to any degree of minuteness; and through which the
animal

animal draws its thread with great assiduity. As every thread proceeds from two gum bags, it is probable that each supplies its own; though they become united, as they proceed from the animal's body. If we examine the thread with a microscope, it will be found that it is flatted on one side, and grooved along its length: whence we may infer, that it is doubled just upon leaving the body; and that the two threads stick to each other by that gummy quality of which they are possessed. Previously to spinning its web, the silk worm seeks out some convenient place to erect its cell, without any obstruction. When it has found a leaf, or a chink fitted to its purpose, it begins to wreathe its head in every direction, and fastens its thread on every side of its retreat. Though all its first essays seem perfectly confused, yet they are not altogether without design; there appears, indeed, no order or contrivance in the disposal of its first threads; they are by no means laid artfully over each other, but are thrown out at random, to serve as an external shelter against rain; for nature having appointed the animal to work upon trees in the open air, its habits remain, though it is brought up in a warm apartment.

Malpighi pretends to have observed six different layers in a single cone of silk: but what may be easily observed is, that it is composed externally of a kind of rough cotton-like substance, which is called floss; within, the thread is more distinct and even; and next the body of the aurelia, the apartment seems lined with a substance of the hardness of paper, but of a much stronger consistence. The thread which goes to compose the cone, is not rolled round, as we roll a bottom, but lies upon it in a very irregular manner, and winds off first from one side of the cone, and then from the other. This whole thread, if measured, will be found about 300 yards long: and so very fine, that eight or ten of them are generally rolled off into one by the manufacturers. The cone, when completed, is in form like a pigeon's egg, and more pointed at one end than the other; at the smaller end, the head of the aurelia is usually found; and this is the place that the insect, when converted into a moth, is generally seen to burst through.

It is commonly a fortnight or three weeks before the aurelia changes into a moth; but no sooner is the winged insect completely formed, than having divested itself of its aurelia

lia skin, it prepares to bust through its cone, or outward prison: for this purpose it extends its head towards the point of the cone, butts with its eyes, which are rough, against the lining of its cell, wears it away, and at last pushes forward, through a passage which is small at first, but which enlarges as the animal encreases its efforts for emancipation; while the tattered remnants of its aurelia skin lie in confusion within the cone, like a bundle of dirty linen.

The animal, when thus set free from its double confinement, appears exhausted with fatigue, and seems produced for no other purpose but to generate a future brood. The male at first seeks the female, and have impregnated her eggs, dies in a few days after; the female lives for some time, it being frequently a month or two before she deposits her eggs, which are not hatched until the ensuing spring. There are few, however, of these animals suffered to come to a state of maturity; for as their bursting through the cone destroys the silk, the manufacturers take care to kill the aurelia, by exposing it to the sun, before the moth comes to perfection. This done, they take off the floss, and throw the cones into warm water, stirring

stirring them till the first thread offers them a clue for winding all off. They generally take eight of the silken threads together; the cones still kept under water, till a proper quantity of the silk is wound off: they do not however take all; for the latter parts grow weak, and are of a bad colour. As to the paper like substance which remains, some stain it with a variety of colours, to make artificial flowers; others let it lie in the water, till the glutinous matter which cements it is all dissolved: it is then carded like wool, spun with a wheel, and converted into silk stuffs of an inferior kind.

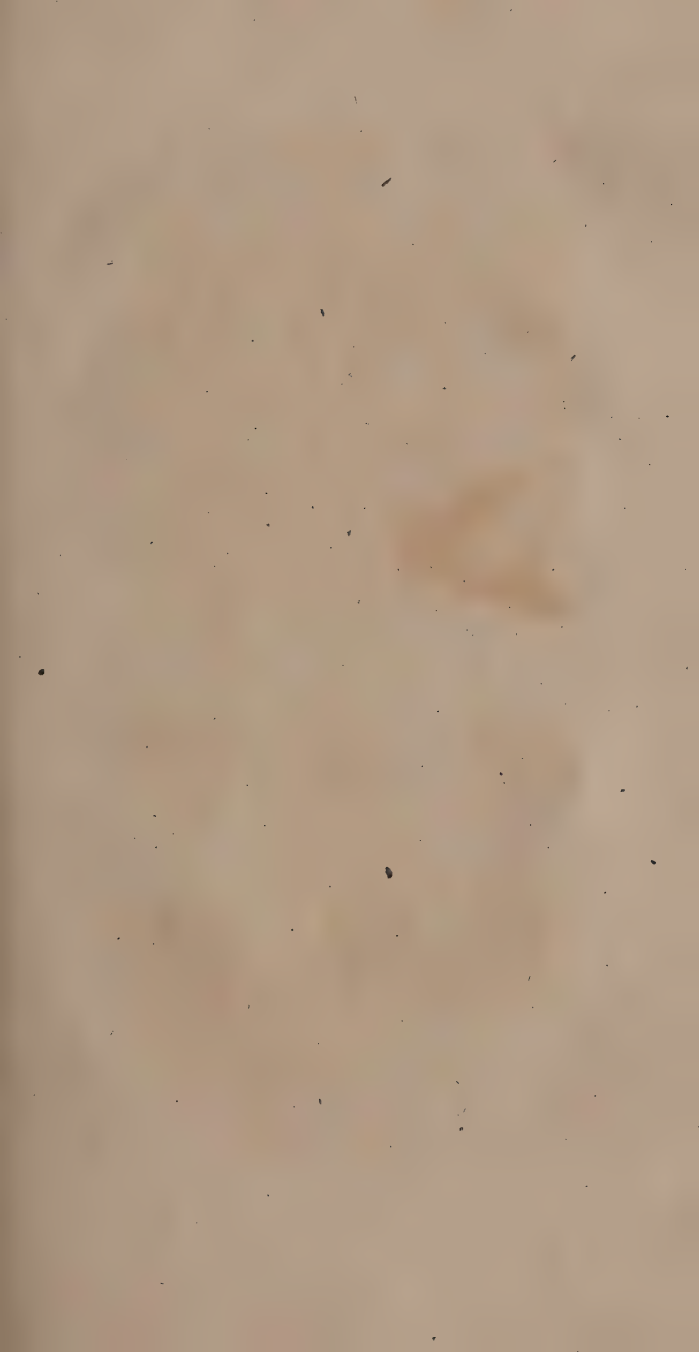




FIG. 146.



FIG. 147.



FIG. 148.



FIG. 149.



FIG. 150.



FIG. 151.



FIG. 152.



FIG. 153.



FIG. 154.



FIG. 155.



FIG. 156.

OF THE FOURTH ORDER OF INSECTS.

IN this class naturalists have placed such as are at first laid in the form of eggs, then excluded in that of maggots, or grubs, (differing very essentially from the caterpillar, of which we have just treated, particularly in wanting the number of feet) afterwards changed into aurelias, but with their legs and wings visible, and, lastly, assuming wings, in which state they propagate their kind. Some of these have four transparent wings, as bees; some have two membranous cases to their wings, as beetles; and some have but two wings which are transparent, as ants. In this class, therefore, are to be found the bee, the wasp, the humble bee, the ichneumon fly, the gnat, the tipula, or longlegs, the beetle, the may-bug, the glow-worm, the ant, and all their varieties. The transformations which all these undergo are nearly similar; and though very different animals in form, are yet produced nearly in the same manner.

The

The *Bee* is most undoubtedly entitled to our first notice, both from its evident superior instincts, and from the great benefits which mankind derive from its labour and industry. No animal in the creation has excited so much curiosity; and many individuals of various talents, have made the history of the bee their study and pleasure; it is no wonder, therefore, that some contradiction is to be met with. Rheaumur, was particularly attentive to this insect, and from his knowledge in natural history has certainly left the best account of it, and which, as being confirmed by the latter experiments of Debray, we shall entirely follow.

There are three different kinds of bees in every hive. First, the labouring bees, which make up by far the greatest number, and are thought to be neither male nor female, but merely born for the purposes of labour, and continuing the breed, by supplying the young with provision, while yet in their helpless state. The second sort are the drones; they are of a darker colour, longer, and more thick by one third than the former; they are supposed to be the males; and there are not above a hundred of them, in a hive of seven or eight thousand bees.

bees. The third sort are still larger and fewer in number; some assert that there is not above one in every swarm: but this, later observers affirm not to be true, there being sometimes five or six in the same hive. These are called queen-bees, and are said to lay all the eggs from which the whole swarm is hatched in the season.

In examining the structure of the common working bee, the first remarkable part that offers is the trunk, which serves to extract the honey from flowers. It is not formed, like that of other flies, in the manner of a tube, by which the fluid is to be sucked up; but like a besom, to sweep, or a tongue, to lick it away. The animal is furnished also with teeth, which serve it in making wax, which is also gathered from flowers, like honey. In the thighs of the hind legs there are two cavities, edged with hair; and into these, as into a basket, the animal sticks its pellets. Thus employed, the bee flies from flower to flower, encreasing its store, and adding to its stock of wax; until the bale, upon each thigh, becomes as big as a grain of pepper; by this time having got a sufficient load, it returns, making the best of its way to the hive.

The belly of the bee is divided into six rings, which shorten the body, by slipping one over the other. It contains within it, besides the intestines, the honey-bag, the venom-bag, and the sting. The honey bag is as transparent as crystal, containing the honey that the bee has brushed from the flowers; of which the greater part is carried to the hive, and poured into the cells of the honey-comb: while the remainder serves for the bee's own nourishment: for during the summer, it never touches what has been laid up for the winter. The sting, which serves to defend this little animal from its enemies, is composed of three parts: the sheath, and two darts, which are extremely small and penetrating. Both the darts have several small points or barbs, like those of a fish-hook; which renders the sting more painful, and makes the darts rankle in the wound. Still, however, this instrument would be very slight, did not the bee poison the wound. The sheath, which has a sharp point, makes the first impression; which is followed by that of the darts, and then the venomous liquor is poured in. The sheath sometimes sticks so fast in the wound, that the animal is obliged to leave it behind; by which the bee soon after dies.

dies, and the wound is considerably enflamed. It might at first appear well for mankind, if the bee were without its sting: but, upon recollection, it will be found that the little animal would then have too many rivals in sharing its labours. A hundred other lazy animals, fond of honey, and hating labour, would intrude upon the sweets of the hive; and the treasure would be carried off, for want of armed guardians to protect it.

The bee is a gregarious animal, and is not only subject to laws, but active, vigilant, laborious, and disinterested. All its provisions are laid up for the community; and all its arts in building a cell, designed for the benefit of posterity. The substance with which bees build their cells is wax; which is fashioned into convenient apartments for themselves and their young. When they begin to work in their hives, they divide themselves into four companies; one of which roves in the fields in search of materials; another employs itself in laying out the bottom and partitions of their cells; a third is employed in making the inside smooth from the corners and angles; and the fourth company bring food for the rest, or relieve those who return with their respective

burthens. But they are not constant to one employment ; they often change the tasks assigned them ; those that have been at work, are permitted to go abroad ; and those that have been in the fields already, take their places. They seem even to have signs, by which they understand each other ; for when any of them want food, it bends down its trunk to the bee from whom it is expected, which then opens its honey-bag, and lets some drops fall into the other's mouth. Their diligence and labour is so great, that, in a day's time, they are able to make cells, which lie upon each other, numerous enough to contain three thousand bees.

Their cells are formed in the most exact proportion. It was said by Pappus, an ancient geometrician, that of all figures, hexagons were the most convenient ; for, when placed touching each other, the most convenient room would be given, and the smallest lost. The cells of the bees are perfect hexagons : these, in every honey-comb, are double, opening on either side, and closed at the bottom. The bottoms are composed of little triangular panes, which, when united together, terminate in a point,

point, and lie exactly upon the extremities of other panes of the same shape, in opposite cells. These lodgings have spaces, like streets, between them, large enough to give the bees a free passage in and out; and yet narrow enough to preserve the necessary heat. The mouth of every cell is defended by a border, which makes the door a little less than the inside of the cell, which serves to strengthen the whole. They serve for different purposes: for laying up their young, for their wax, and for their honey, which makes their principal subsistence.

The habitation of bees require to be very close; and what their hives want, from the negligence or unskilfulness of man, these animals supply by their own industry: so that it is their principal care, when first lived, to stop up all the crannies. For this purpose, they make use of a resinous gum, which is more tenacious than wax, and differs greatly from it. This the ancients called *propolis*: it will grow considerably hard in June, though it will in some measure soften by heat; and is often found different in consistence, colour, and smell. It has generally an agreeable aromatic odour when it is warmed; and by some it is considered

considered as a most grateful perfume. When the bees begin to work with it, it is soft, but it acquires a firmer consistence every day; till at length it assumes a brown colour, and becomes much harder than wax. The bees carry it on their hinder legs; and some think it is met with on the birch, the willow, and poplar.

The swarm, when examined through a glass hive, seem, from their hurry, to be all anarchy and confusion: but the spectator soon finds every animal diligently employed, and following one pursuit, with a settled purpose. Their teeth are the instruments by which they model and fashion their various buildings, and give them such symmetry and perfection. They begin at the top of the hive; and several of them work at a time, at the cells which have two faces. If they are stinted with regard to time, they give the new cells but half the depth which they ought to have; leaving them imperfect, till they have sketched out the number of cells necessary for the present occasion. The construction of their combs, costs them a great deal of labour: they are made by insensible additions; and not cast at once into a mold.

The

The cells for their young are most carefully formed; those designed for lodging the drones, are larger than the rest; and that for the queen-bee, the largest of all. Honey is not the only food upon which these animals subsist. The meal of flowers, of which their wax is formed, is one of their most favourite repasts. This is a diet which they live upon during the summer, and of which they lay up a large winter provision. The wax of which their combs are made, is no more than this meal digested, and wrought into a paste. When the flowers upon which bees generally feed, are not fully blown, and this meal or dust is not offered in sufficient quantities, the bees pinch the tops of the stamina in which it is contained, with their teeth; and thus anticipate the progress of vegetation. In April and May the bees are busy, from morning to evening, in gathering this meal; but when the weather becomes too hot in the midst of summer, they work only in the morning.

The bee is furnished with a stomach for its wax as well as its honey. In the former of the two, their powder is altered, digested and concocted into real wax: and is thus ejected by the same passage by which it was swallowed.

Every

Every comb, newly made, is white: but it becomes yellow as it grows old, and almost black when kept too long in the hive. Beside the wax thus digested, there is a large portion of the powder kneaded up for food in every hive, and kept in separate cells, for winter provision; this is called *bee-bread*, and contributes to the health and strength of the animal during winter.

Numerous as the multitude of bees may appear in one swarm, they all owe their origin to a single parent, which is called the queen-bee; and Rheaumur assures us, that opening one of them, he found no less than five thousand eggs. This animal, whose existence is of such importance to the community, may easily be distinguished from the rest by her size, and the shape of her body. On her safety depends the whole welfare of the commonwealth; and the attentions paid to her by all the the rest of the swarm, evidently shew the dependence her subjects have upon her security.

The queen-bee is generally concealed in the most secret part of the hive, and is seldom visible but when she lays her eggs, in such combs as are exposed to sight. When she does appear, she is always attended by ten or a dozen

of the common sort, who form a kind of retinue, and follow her wherever she goes with a sedate and grave tread. Those which compose her train are supposed to be the males, who impregnate her by turns. Before she lays her eggs, she examines the cells where she designs to deposit them, and if she finds that they contain neither honey, wax, nor any embryo, she introduces the posterior part of her body into a cell, and fixes to the bottom of it a small white egg, which is composed of a thin white membrane, full of a whitish liquor. In this manner she goes on, leaving one in each cell until she has visited as many cells as she has eggs, which commonly amount to some thousands. Sometimes more than one egg is deposited in the same cell, but when this is the case, the working bees remove the supernumerary eggs, and leave one in each. A day or two after it is deposited, the worm is excluded from the shell of the egg, having the appearance of a maggot rolled up in a ring, and lying softly on a bed of a whitish coloured jelly; upon which also the little animal begins to feed. In the mean time, the instant it appears, the working bees attend it with the most anxious and parental tenderness. Thus attended, and plentifully

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fed, the worm, in less than six days time, comes to its full growth, and no longer accepts the food offered it. When the bees perceive that it has no further occasion for feeding, they perform the last offices of tenderness, and shut up the little animal in its cell; they wall up the mouth of its apartment with wax: and there they leave the worm to itself, having secured it from every external injury.

The worm is no sooner left enclosed, but, from a state of inaction, it begins to labour, extending and shortening its body; and by this means lining the wall of its apartment with a silken tapestry, which it spins in the manner of caterpillars, before they undergo their last transformation. When their cell is thus prepared, the animal is soon after transformed into an aurelia; but differing from that of the common caterpillar, as it exhibits not only the legs, but the wings of the future bee, in its present state of inactivity. Thus, in about twenty, or one and twenty days after the egg was laid, the bee is completely formed, and fitted to undergo the fatigues of its state. When all its parts have acquired their proper strength and consistence the young animal opens its prison, by piercing with its teeth the waxen door that confines it.

it. When first freed from its cell, it is moist, and incommoded with the spoils of its former situation; but the officious bees are soon seen to flock round it, and to lick it clean on all sides with their trunks; while another band with equal assiduity, are observed to feed it with honey: others again begin immediately to cleanse the cell that has been just left; to carry the ordures out of the hive, and to fit the place for a new inhabitant. The young bee soon repays their care, by its industry, for as soon as ever its external parts become dry, it discovers its natural appetites for labour, and industriously begins the task, which it pursues unremittingly through life.

The bees depart from their usual stile of building when they are to raise cells for such maggots as are destined to become queens. These are of a longish oblong form, having one end bigger than the other, with their exterior surface full of little cavities. Wax, which is employed with so geometrical a thriftiness in the raising of hexagonal cells, is expended with profusion in the cell which is to be the cradle of a royal maggot. Several common cells are sacrificed to serve as a basis and support to it. It is placed almost perpendicular to the com-

mon cells, the largest end being uppermost. The lower end is open till the season for closing it comes, and the maggot is ready for transformation. It would be difficult to conceive how a tender maggot can remain in a cell turned bottom upwards, if we did not find it buried in a substance scarcely fluid, and if it were not in itself, as first, small and light enough to be suspended in this clammy paste. As it grows, it fills all the larger and upper parts of the cell. As soon as the young queen comes out, her cell is destroyed, and its place is supplied by common ones; but as the foundation of the royal cell is left, this part of the comb is found thicker than any other. They take care to prepare several such cells to guard, as it were, against accidents: for if there were only one reared in each hive, the swarms might often want a conductress; or the little maggot might chance to be destroyed before it came to a bee. It is, therefore, necessary that a number of such cells should be provided; and accordingly there are observed several young queens in every hive at the beginning of summer.

A young queen is in a condition to lead a swarm from a hive in which she was born in four or five days after she has appeared in it with wings.

wings. The bees of a swarm are in a great hurry if their queen is ready to lay. In this case they give to their new cells but part of the depth they are to have, and defer the finishing them till they have traced the number of cells requisite for the present time. When, by any accident the queen dies, the bees of her hive immediately cease working, consume their own honey, fly about their own and other hives at unusual hours, when other bees are at rest, and pine away if not soon supplied with another sovereign. Her loss is proclaimed by a clear and uninterrupted humming; but if they procure another queen, even from any other hive or swarm, the flock instantly revives, pleasure and activity are apparent through the whole hive; the presence of a sovereign restores vigour and exertion, and her voice commands universal respect and obedience.

In the space of a few weeks, the number of the inhabitants in one hive, of moderate size, becomes so great, that there is no place to contain the new comers. While there is room enough in the hive, they remain quietly together; but necessity compels a separation. Sometimes the young brood refuse to depart, and even venture to resist their progenitors.

The

The young ones are known by being browner than the old, with whiter hair; the old ones are of a lighter colour, with red hair. The two armies are therefore easily distinguishable, and dreadful battles are often seen to ensue. But the victory almost ever terminates in favour of the veterans, and the rebellious offspring are driven off, not without loss and mutilation.

Sometimes, indeed, there being another queen, numbers of them both young and old, will unite under her, and set off in a body to establish a new colony wherever she leads them. An unusual buzzing is heard in the hive on the night previously to this intended migration: in the morning, though the weather be ever so inviting, they do not come out; all labour is discontinued in the hive, every bee is either employed in forcing, or reluctantly yielding a submission; at length, after some noise and tumult, a queen-bee is chosen, to guard, rather than conduct, the young colony to other habitations, and then they are marshalled without any apparent conductor. The usual time of swarming, is from ten in the morning, to three in the afternoon, when the sun shines bright, and invites them to seek their fortunes. They flutter for a while, in the air, and sometimes

times undertake a distant journey, but more frequently are contented with some neighbouring asylum; the branch of a tree, a chimney top, or some other exposed situation. It sometimes is found, that there are two or three queens to a swarm, and the colony is divided into parties; but it most usually happens, that one of these is more considerable than the other, and the bees by degrees, desert the weakest, to take shelter under the most powerful protector. The deserted queen does not long survive this defeat: she takes refuge under the new monarch, and is soon destroyed by her jealous rival. Till this cruel execution is performed, the bees never go out to work; and if there should be a queen-bee, belonging to the new colony, left in the old hive, she always undergoes the fate of the former. It must be observed, however, that the bees never sacrifice any of their queens, when the hive is full of wax and honey; for there is at that time no danger in maintaining a plurality of breeders.

When the swarm is thus conducted to a place of rest, and the policy of government is settled, the bees soon resume their former labours. The making cells, storing them with honey, impregnating the queen, making pro-
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per cells for the reception of the rising progeny, and protecting them from external danger, employ their unceasing industry. But soon after, and towards the latter end of summer, when the colony is sufficiently stored with inhabitants, the drone bees are marked for slaughter, and soon destroyed.

When the flowers that are near home are rifled, then are these industrious insects seen taking more extensive ranges, but if they are obliged, in quest of honey, to go too far from home, they are over-wearied in the pursuit, devoured by birds, or beaten down by the winds and rain. From a knowledge of this, in some parts of France and Piedmont, they have contrived a kind of floating bee-house, containing a number of hives, with which they gently float down the sides of the river.

Besides the capital instincts which we have already mentioned, bees are possessed of others, some of which are equally necessary for their preservation and happiness. They anxiously provide against the entrance of insects into the hive, by gluing up with wax the smallest holes in the skep. Some stand as centinels at the mouth of the hive, to prevent insects of any kind from coming in that way; but if a snail,
or

or any other large insect, should get in, notwithstanding all resistance, they sting it to death; and then cover it over with a coat of propolis, to prevent the effects of a bad smell, or maggots, which might proceed from its putrefaction. They seem also to be warned of the approach of bad weather by some particular feeling. It sometimes happens, even when they are very assiduous and busy, that they suddenly cease from their work; not a single one stirs out, and those that are abroad hurry home in such prodigious crowds, that the doors of their habitations are too small to admit them. On this occasion look up to the sky, and you will soon discover some of those black clouds which denote impending rain. Whether they see the clouds gathering for it, as some imagine, or whether they feel some other effects of it upon their bodies, is not yet determined; but it is alledged, that no bee is ever caught, even in what we call a sudden shower, unless it have been at a very great distance from the hive, or been before injured by some accident, or be sickly and unable to fly as fast as the rest. Cold is a very great enemy to them: to defend themselves against its effects during a hard winter, they crowd together in the middle of the hive,

and buzz about, thus exciting a warmth which is often perceptible by laying the hand on the glass windows of the hive. They seem to understand one another by the motion of their wings. When the queen wants to quit the hive, she gives a little buzz; all the others immediately follow her example, and retire along with her.

There often happen among bees, either of the same, or of different hives; most deadly feuds, in which their stings are their chief weapons. In these contests, great skill may be discerned in the manner of pointing the sting between the scaly rings which cover their bodies, or to some other vulnerable part. The bee which first gains the advantage remains the conqueror; though the victory costs the victor his life, if he has left his sting in the body of the enemy; for, with the sting, so much of the body is torn out, that death inevitably follows. Bees have very severe conflicts when whole hives engage in a pitched battle, and many are slain on both sides. Thorley thinks their fighting and plundering one another ought chiefly to be imputed either to their perfect abhorrence of sloth and idleness, or to their insatiable thirst for honey; for when, in spring or autumn, the weather

weather is fair, but no honey can be collected from plants, and is to be found only in the hives of other bees, they will venture their lives to get it there. Dr. Warder is of opinion, that the cause of their fighting is the necessity to which they are reduced from their own hives being plundered at a season when it is too late for them to repair the loss by any industry in the fields.

Sometimes one of the queens is killed in battle: in that case the bees of both hives unite as soon as her death is generally known among them. All then become one people; if it be the queen of the attacked which falls, the vanquished go off with the robbers, richly laden with their own spoils, and return every day with their new associates to pillage their old habitation.

It is well known that bees gather two kinds of wax, one coarse and the other fine. The coarser sort is bitter, and with this, which is called propolis, they stop up all the holes and crevices of their hives. It is of a more resinous nature than the fine wax, and is consequently better qualified to resist the moisture of the season, and preserve the works warm and dry within. The fine wax is as necessary to the

animal's preservation as the honey itself. With this they make their lodgings, with this they cover the cells of their young, and in this they lay up their magazines of honey.

As of wax, there are also two kinds of honey. The white and the yellow. The white is taken without fire from the honey-combs, the yellow is extracted by heat, and squeezed through bags in a press. Honey made in mountainous countries, is preferable to that of the valley. The honey made in the spring, is best, the summer next, and that in autumn the most inferior.

Bees are nearly alike in all parts of the world, yet these are differences worthy our notice. In Guadaloupe, the bee is less by one half than the European, and more black and round. They have no sting, and make their cells in hollow trees; where, if the hole they meet with be too large, they form a sort of waxen house, of the shape of a pear, and in this they lodge and store their honey, and lay their eggs. They lay up their honey in waxen vessels of the size of a pigeon's egg, of a black or deep violet colour, and these are so joined together, that there is no space left between them. The honey never congeals, but is fluid

fluid of the consistence of oil, and the colour of amber. There are also little black bees found without a sting in all the tropical climates, and which resemble the former. The honey they produce, is neither so unpalatable, nor so surfeiting as ours; and the wax is so soft, that it is only used for medicinal purposes.

The *Humble Bee* is the largest of another tribe, being as large as the first joint of a man's middle finger. These are seen in every field, and perched on every flower. They build their nest in holes in the ground, of dry leaves, mixed with wax and wool, defended with moss from the weather. Each humble-bee makes a separate cell, about the size of a small nutmeg, which is round and hollow, containing the honey in a bag. Several of these cells are joined together, in such a manner, that the whole appears like a cluster of grapes. The females, which have the appearance of wasps, are very few, and their eggs are laid in cells, which the rest soon cover over with wax. It is uncertain whether they have a queen or not; but there is one much larger than the rest, without wings, and without hair, and all over black, like polished ebony. This goes and views

all the works, from time to time, and enters into the cell, as if it wanted to see whether every thing were properly performed; in the morning, the young humble-bees are very idle, and seem not at all inclined to labour, till one of the largest, about seven o'clock, thrusts half its body from a hole, designed for that purpose, and seated on the top of the nest, beats its wings for twenty minutes successively, buzzing the whole time, till the whole colony is put in motion. The humble-bees; gather honey, as well as the common bees; but it is neither so fine, nor so good, nor is the wax so clean, or so capable of fusion.

There are various kinds of bees which make only wax; such as the *Wood-bee*, which is seen in every garden. It is rather larger than the common queen-bee; its body of a bluish black, which is smooth and shining. It begins to appear at the approach of spring, and is seen flying near walls exposed to a sunny aspect. This bee makes its nest in some piece of half rotten wood, which it contrives to scoop and hollow for its purpose. The holes are not made directly forward, but turning to one side, and have a small opening; whence runs the inner apartment, generally twelve or fifteen inches long.

long. The instruments used in boring these cavities, are their teeth; the cavity is usually branched into three or four apartments; and in each of these they lay their eggs, to the number of ten or twelve, each separate and distinct from the rest. The egg is involved in a sort of paste, which serves at once for the young animal's protection and nourishment. The grown bees, however, feed upon small insects, particularly a louse, of a reddish brown colour, of the size of a small pin's head.

Mason-bees fabricate their cells with a sort of mortar made of earth, which they build against a wall that is exposed to the sun. The mortar, which is at first soft, soon becomes as hard as stone, and in this their eggs are laid. Each nest contains seven or eight cells, and an egg in every cell, placed regularly one over the other. If the nests remains unhurt, or want but little repairs, they make use of them the year ensuing: and thus they often serve three or four years successively.

The *Ground-bee* builds its nest in the earth, in which they make round holes, five or six inches deep; the mouth being narrow, and only
just

just sufficient to admit the little inhabitant. They carry out all the earth, grain by grain, to the mouth of the hole, where it forms a little hillock, an Alps compared to the power of the artist by which it was raised. They lay up in these cavities provision for their young, which consists of a paste that has the appearance of corn, and is of a sweetish taste.

The *Leaf-cutting bees* make their nest and lay their eggs among bits of leaves, very artificially placed in holes in the earth, of about the length of a tooth-pick case. They make the bits of leaves of a roundish form, and with them line the inside of their habitations. This tapestry is still further lined by a reddish kind of paste, sometime rather sweets and at others acid. These bees are of various kinds; those that build their nests with chesnut-leaves are as big as drones, but those of the rose-tree are smaller than the common bee.

The *Wall bees* are so called because they make their nests in walls, of a kind of silky membrane with which they fill up their vacuities between the small stones which form the sides of their habitation. Their apartment consists
of

of several cells, placed end to end, each in the shape of a woman's thimble. Though the web which lines this habitation is thick and warm, yet it is transparent and of a whitish colour. This substance is supposed to be spun from the animal's body; the males and females are of a size, but the former are without a sting. To these varieties of the bee kind might be added several others which are all different in nature, but not sufficiently distinguished to excite curiosity.

The *Wasp* is also a winged insect with a sting; it is longer in proportion to its bulk than the bee, is marked with bright yellow circles round its body, and is the most swift and active insect of all the fly kind. On each side of the mouth this animal is furnished with a long tooth notched like a saw, and with these it is enabled to cut any substance, not omitting meat itself, and to carry it to its nest. Wasps live like bees in community, and sometimes ten or twelve thousand are found inhabiting a single nest.

Of all insects the wasp is the most fierce, voracious, and most dangerous, when enraged. They are seen wherever flesh is cutting up, gor-

ging themselves with the spoil, and then flying to their nest with their reeking prey. They make war also on every fly, and the spider itself dreads their approaches.

Every community among bees is composed of females, or queens; drones, or males, and neutral, or working bees. Wasps have similar occupations; the two first are for propagating the species, the last for nursing, defending, and supporting the rising progeny. Among bees, however, there is seldom above one queen or two in a hive; among wasps there are above two or three hundred.

The wasp is among the first insects that are drawn into activity by the warmth of the summer. They immediately set about preparing their nest, for which, their principle care is to seek out a hole that has been begun by a field mouse, a rat, or a mole. They sometimes build upon the plain, where they are sure of the dryness of their situation, but most commonly on the side of a bank, to avoid the rain and water that would otherwise annoy them. When they have chosen a proper place, they go to work with wonderful assiduity. Their first labour is to enlarge and widen the hole, taking away the earth and carrying it off to
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some distance. To prevent the earth from falling down and crushing their rising city into ruin, they make a sort of roof with their gluey substance, to which they begin to fix the rudiments of their building, working from the top downwards, as if they were hanging a bell, which, however, at length, they close up at the bottom. The materials with which they build their nests, are bits of wood and glue. The wood they get where they can, from the rails and posts which they meet with in the fields, and elsewhere. These they divide into a multitude of small fibres, and then take up little bundles in their claws, letting fall upon them a few drops of gluey matter with which their bodies are provided; and by the help of which they knead the whole composition into a paste, which serves them in their future building. When they have returned with this to the nest, they stick their load of paste on that part where they make their walls and partitions; they tread it close with their feet, and trowel it with their trunks, still going backwards as they work. Having repeated this operation three or four times, the composition is at length flatted out until it becomes a small leaf of a grey colour, much finer than paper, and of a pretty firm

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texture.

texture. This done, the same wasp returns to the field to collect a second load of paste, repeating the same several times, placing layer upon layer, and strengthening every partition in proportion to the want or convenience of the general fabric. Other working wasps come quickly after to repeat the same operation, laying more leaves upon the former, till at length, after much toil, they have finished the large roof which is to secure them from the tumbling in of the earth. This dome being finished, they make another entrance to their habitation, designed either for letting in the warmth of the sun, or for escaping in case one door be invaded by plunderers. Certain however it is, that by one of these they always enter, by the other they sally forth to their toil; each hole being so small that they can pass but one at a time. The walls being thus composed, and the whole somewhat of the shape of a pear, they labour at their cells, which they compose of the same paper-like substance that goes to the formation of the outside works. Their combs differ from those of bees, the latter being edgeways with respect to the hive; that of the wasp is flat, and the mouth of every cell opens downwards. Thus is their habitation, contrived story above story,

story, supported by several rows of pillars, which give firmness to the whole building, while the upper story is flat-roofed, and as smooth as the pavement of a room laid with squares of marble. The wasps can freely walk upon these stories between the pillars to do whatever their wants require. The pillars are very hard and compact, being larger at each end than in the middle, not much unlike the columns of a building. All the cells of the nests are only destined for the reception of the young, being replete with neither wax nor honey.

Each cell is like that of the bee, hexagonal; but they are of two sorts, the one larger, for the production of the male and female wasps, the other less, for the reception of the working part of the community. When the females are impregnated by the males, they lay their eggs, one in each cell, and stick it in with a kind of gummy matter to prevent it from falling out. From this egg proceeds the insect in its worm state, of which the old ones are extremely careful, feeding it until it has grown so large as entirely to fill up the cell. But the wasp community differs from that of the bee; among the latter, the working bees take the parental

rental duties upon them, while among the wasps the females alone are permitted to feed their young, and to nurse their rising progeny. For this purpose the female waits with great patience till the working wasps have brought in their provisions, which she takes from them, and cuts into pieces. She then goes with great composure from cell to cell, and feeds every young one with her mouth. When the young worms have come to a certain size, they leave off eating, and begin to spin a very fine silk, fixing the first end to the entrance of the cell, then turning their heads, first on one side, then on the other, they fix the thread to different parts, and thus they make a sort of a door which serves to close up the mouth of the cell. After this they divest themselves of their skins in the usual manner, and the aurelia by degrees begins to emancipate itself from its shell: by little and little it thrusts out its legs and wings, and insensibly acquires the colour and shape of its parent.

The wasp thus formed, and prepared for depredation, becomes a bold, troublesome, and dangerous insect: there are no dangers which it will not encounter in pursuit of its prey, and nothing seems to satiate its gluttony. Though

it can gather no honey of its own, no animal is more fond of sweets. For this purpose, it will pursue the bee and the humble-bee, destroy them with its sting, and then plunder them of their honey-bag, with which it flies triumphantly laden to its nest to regale its young. Wasps are always fond of making their nest in the neighbourhood of bees, merely to have an opportunity of robbing their hives, and feasting on the spoil. Yet the bees do not always patiently submit to their tyranny, but fierce battles are sometimes seen to ensue, in which the bees make up by conduct and numbers what they want in personal prowess. When there is no honey to be had, they seek for the best and sweetest fruits, and they are never mistaken in their choice. From the garden they fly to the city, to the grocers shops, and butchers shambles. They will sometimes carry off bits of flesh half as big as themselves, with which they fly to their nests for the nourishment of their brood. Those who cannot drive them away, lay for them a piece of ox's liver, which being without fibres, they prefer to other flesh; and wherever they are found, all other flies are seen to desert the place immediately. Such is the dread with which these little animals im-

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press all the rest of the insect tribes, whom they seize and devour without mercy. Wherever they fly, like the eagle or the falcon, they form a desert in the air around them. In this manner the summer is passed in plundering the neighbourhood, and rearing up their young; every day adds to their numbers; and from their strength, agility, and indiscriminate appetite for every kind of provision, were they as long-lived as the bee, they would soon swarm upon the face of Nature, and become the most noxious plague of man: but providentially their lives are measured by their powers of mischief, and they live but a single season. In proportion as the cold of the winter encreases, they are seen to become more domestic; they seldom leave the nest, they make but short adventures from home, they flutter about in the noon-day heats, and soon after return chilled and feeble.

As their calamities increase, new passions begin to take place; the care for posterity ceases, and as the parents are no longer able to provide their growing progeny with a supply, they take the barbarous resolution of sacrificing them all to the necessity of the times. In this manner, like a garrison upon short

short allowance, all the useless hands are destroyed; the young worms, which a little before they fed and protected with so much assiduity, are now butchered and dragged from their cells. As the cold encreases, they no longer find sufficient warmth in their nests, which grow hateful to them; and they fly to seek it in the corners of houses, and places that receive an artificial heat. But the winter is still insupportable; and, before the new year begins, they wither and die; the working wasps first, the males soon following, and many of the females suffering in the general calamity.

In every nest, however, one or two females survive the winter, and having been impregnated by the male during the preceding season, she begins in spring to lay her eggs in a little hole of her own contrivance. These eggs, which are clustered together like grapes, soon produce two worms, which the female takes proper precaution to defend and supply, and these, when hatched, soon give assistance to the female, who is employed in hatching two more; these also gathering strength, extricate themselves out of the web that enclosed them; and become likewise assistants to their mother: fifteen days after, two more make their appear-

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ance; thus is the community every day encreasing, while the female lays in every cell, first a male and then a female. These soon after become breeders in turn, till, from a single female, ten thousand wasps are seen produced before the month of June.

The *Hornet* is twice as large as the common wasp, and is also distinguished by a black breast, and double black spots on the belly; the head is also longer and more slender, and the eyes somewhat resembling a half moon. It is extremely bold and venomous. Its predominant passion is for flesh, and when hungry, two or three of them will seize upon a small bird, kill it, and devour its flesh. Nay, it has even been said, that singly, it will attack and conquer a sparrow. In all its manners and habits, it entirely resembles the other wasps.

Besides these, there are various tribes that live in solitude: these lay their eggs in a hole for the purpose, and the parent dies long before the birth of her offspring. In the principal species of the *Solitary Wasps*, the insect is smaller than the working wasp of the social kind. The filament, by which the corselet is joined to the body is longer and more distinctly seen, and the whole colour of the insect is
blacker

blacker than in the ordinary kinds. But it is not their figure, but the manners of this extraordinary insect, that claim our principal regard.

From the end of May to the beginning of July, this wasp is seen most diligently employed, in contriving and fitting up a commodious apartment for its young one, which however, is not to succeed it till the ensuing year. For this purpose it bores a hole into the finest earth some inches deep, but not much wider than the diameter of its own body. This is only a gallery leading to a wider apartment. As it always chooses a gravelly soil to work in, and where the earth is almost as hard as stone itself, the digging and hollowing this apartment is an enterprise of no small labour; and for effecting which this insect is furnished with two teeth, that are strong and firm, but not sufficiently hard to penetrate the substance through which it is resolved to make its way: in order, therefore, to soften that earth which it is unable to pierce, it is furnished with a gummy liquor which it emits upon the place, and which renders it more easily separable from the rest, and the whole becoming a kind of soft

paste is removed to the mouth of the habitation. The animal's provision of liquor in these operations is however soon exhausted; and it is then seen taking up water from some neighbouring flower, or stream, in order to supply the deficiency.

At length after much toil, a hole some inches deep is formed, at the bottom of which is a large cavity; and to this no other hostile insect would venture to find its way, from the length and narrowness of the defile through which it would be obliged to pass. In this the solitary wasp lays its eggs, which is destined to continue the species: there the nascent animal is to continue for above nine months, unattended and immured, and, at first appearance the most helpless insect of the creation. But when we come to examine, new wonders offer: no other insect can boast so copious and luxurious a provision, or such confirmed security.

As soon as the mother-wasp has deposited her egg at the bottom of the hole, her next care is to furnish it with a supply of provisions, which may be offered to the young insect as soon as it leaves the egg. To this end she procures a number of little green worms, generally from eight to twelve, and these are to
serve

serve as food for the young one the instant it awakens into life. When this supply is regularly arranged and laid in, the old one then, with as much assiduity as it before worked out its hole, now closes the mouth of the passages; and thus leaving its young one immured in perfect security, and with a copious supply of animal food, she dies satisfied with having provided for a future progeny.

When the young one leaves the egg it is scarcely visible, and is seen immured among a number of insects, infinitely larger than itself, ranged in proper order around it, which however give it no sort of fear. Whether the parent, when she laid in the insect provision, contrived to disable the worms from resistance, or whether they were at first incapable of any, is not known. Certain it is, that the young glutton feasts upon the living spoil without any controul; its game lies ready, and it devours one after the other as the calls of appetite incite. The life of the young animal is, therefore, spent in the most luxurious manner, till its whole stock of worms is exhausted, and the time of its transformation begins to approach; and then spinning a silken web, it continues fixed in its cell till the sun calls

calls it from its dark abode the ensuing summer.

The wasps of Europe are very mischievous, and yet they are innocence itself when compared to those of the tropical climates, where all the insect tribes are not only numerous, but large, voracious, and formidable. Those of the West Indies are thicker, and twice as long as the common bee; they are of a grey colour, striped with yellow, and armed with a very dangerous sting. They make their cells in the manner of a honey-comb, in which the young ones are hatched and bred. They generally hang their nest by threads, composed of the same substance as the cells, to the branches of trees, and the eaves of houses. They are seen every where in great abundance, descending like fruit, particularly pears, of which shape they are, and as large as one's head. The inside is divided into three round stories, full of cells, each hexagonal, like those of a honey-comb. In some of the islands, these insects are so very numerous, that their nests are stuck up in this manner, scarcely two feet asunder, and the inhabitants are in continual apprehension from their accidental resentment. It sometimes happens, that no precautions can prevent their attacks, and the pains of their sting are almost insupportable. Those who have felt
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it think it more terrible than even that of a scorpion; the whole visage swells and the features are so disfigured, that a person is scarcely known by his most intimate acquaintance.

The Ichneumon Fly. Every rank of insects, however voracious, have enemies that are terrible to them, and that revenge upon them the injuries done upon the rest of the animated creation. The wasp, as we have seen, is very troublesome to man, and very formidable to the insect tribe; but the ichneumon fly (of which there are many varieties) fears not the wasp itself; it enters its retreats, plunders its habitations, and takes possession of that cell for its own young, which the wasp had laboriously built for a dearer posterity.

This fly receives its name from the little quadruped, which is found to be so destructive to the crocodile, as it bears a strong similitude in its courage and rapacity; but though there are many different kinds of it, yet the most formidable, and that best known, is called the common ichneumon, with four wings, like the bee, a long slender black body, and a three forked tail, consisting of bristles; the two outermost black, and the middlemost red. Though
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this instrument is, to all appearance, slender and feeble, yet it is found to be a weapon of great force and efficacy. There is scarcely any substance which it will not pierce: and indeed, it is seldom seen but when employed in penetration. The male is unprovided with such a sting, while the female uses it with great force and dexterity, brandishing it when caught, from side to side, and very often wounding those who thought they held her with the greatest security.

All the flies of this tribe are produced in the same manner, and owe their birth to the destruction of some other insect, within whose body they have been deposited, and upon whose vitals they have preyed, till they came to maturity. There is no insect whatever, which they will not attack in order to leave their fatal present in its body; the caterpillar, the gnat, and even the spider itself, so formidable to others, is often made the unwilling fosterer of this destructive progeny.

About the middle of summer, when other insects are found in great abundance, the ich-néumon is seen flying busily about, and seeking proper objects upon whom to deposit its eggs. As there are various kinds of this fly, so they

seem

seem to have various appetites. Some are found to place their eggs within the aurelia of some nascent insect, others place them within the nest, which the wasp had curiously contrived for its own young; and as both are produced at the same time, the young of the ichneumon not only devours the young wasp, but the whole supply of worms, which the parent had carefully provided for its provision. But the greatest number of the ichneumon tribe are seen settling upon the back of the caterpillar, and darting, at different intervals, their stings into its body. In this manner they leave from six to twelve eggs in the fatty substance without the reptile shewing the least symptoms of receiving any injury, but continues feeding as voraciously as before. Their internal enemies, however, soon burst from their egg state, and begin to prey upon the substance of their prison; as they encrease in growth they require a greater supply, till at last the animal, by whose vitals they are supported, is no longer able to sustain them, but dies, its inside being almost eaten away. It often happens, that the caterpillar survives the worm state of the infant ichneumons, and then they change into a crysalis, enclosed in its body till the time of their delivery approaches,

when they burst their prisons, and fly away. The caterpillar, however, is irreparably destroyed; it never changes into a chrysalis, but it soon dies, from the injuries it has sustained.

We now come to a species of four-winged insects, that are famous from all antiquity, for their social and industrious habits, that are marked for their spirit of subordination, that are offered as a pattern of parsimony to the profuse, and of unremitting diligence to the sluggard; the *Ant.*

In the experiments, however, which have been more recently made, and the observations which have been taken, much of their boasted frugality and precaution seems denied to them; the treasures they lay up, are no longer supposed to be intended for future provision; and the choice they make in their stores, seems no way dictated by wisdom. It is, indeed, somewhat surprising, that almost every writer of antiquity, should describe this insect, as labouring in the summer, and feasting upon the produce during the winter. Perhaps, in some of the warmer climates, where the winter is mild, and of short continuance, this may take place; but in France and England these animals can
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have no manner of occasion for a supply of winter provisions, as they are actually in a state of torpidity during that season.

The common ants of Europe are of two or three sorts; some red, some black, some with stings, and others without. Such as have stings, inflict their wounds in that manner; such as are unprovided with these weapons of defence, have a power of spurting from their hinder parts, an acid pungent liquor, which, if it lights upon the skin, inflames and burns it like nettles.

The body of an ant is divided into the head, breast, and belly. In the head, the eyes are placed, which are entirely black, and under the eyes there are two small horns, or feelers, composed of twelve joints, all covered with a fine silky hair. The mouth is furnished with two crooked jaws, which project outwards, in each of which are seen incisors, that look like teeth. The breast is covered with a fine silky hair, from which project six legs, that are pretty strong and hairy, the extremities of each armed with two small claws, which the animal uses in climbing. The belly is more red than the rest of the body, which is of a brown chesnut

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colour,

colour, shining as glass, and covered with extremely fine hair.

From such a formation, this animal seems bolder, and more active, for its size, than any other of the insect tribe, and does not fear to attack a creature above ten times its own magnitude.

As soon as the winter is past, in the first fine day in April, the ant hill, that before seemed a desert, now swarms with new life, and myriads of these insects are seen just awaked from their annual lethargy, and preparing for the pleasures and fatigues of the season. For the first day they never offer to leave the hill, which may be considered as their citadel, but run over every part of it, as if to examine its present situation, to observe what injuries it has sustained during the rigours of winter, while they slept, and to meditate and settle the labours of the day ensuing.

At the first display of their forces, none but the wingless tribe appears, while those furnished with wings remain at the bottom. These are the working ants, that first appear, and that are always destitute of wings; the males and females that are furnished with four large wings each, are more slow in making their appearance.

Thus,

Thus, like bees, they are divided into males, females, and the neutral, or the working tribe. These are all easily distinguished from each other; the females are much larger than the males; the working are the smallest of all. The two former have wings; which, however, they sometimes are divested of; the latter never have any, and upon them are involved all the labours that tend to the welfare of the community. The female, also, may be distinguished by the colour and structure of her breast, which is a little more brown than that of the common ant, and a little brighter than that of the male. In eight or ten days after their first appearance, the labours of the hill are in some forwardness; the males and females are seen mixed with the working multitude; they seem no way to partake in the common drudgeries, the males pursue the females with great assiduity, and in a manner force them to compliance. They remain coupled for some time; while the males, thus united, suffer themselves to be drawn along by the will of their partners.

In the fields of England, ant-hills are formed with but little apparent regularity. In the more southern provinces of Europe, they are constructed with wonderful contrivance, and

offer

offer a sight highly worthy a naturalist's curiosity. These are generally formed in the neighbourhood of some large tree and a stream of water. The one is considered by the animals, as the proper place for getting food; the other for supplying them with moisture, which they cannot well dispense with. The shape of the ant-hill is that of a sugar-loaf, about three feet high, composed of various substances; leaves, bits of wood, sand, earth, bits of gum, and grains of corn. These are all united into a compact body, perforated with galleries down to the bottom, and winding ways within the body of the structure. From this retreat to the water, as well as to the tree, in different directions, there are many paths worn by constant assiduity, and along these the busy insects are seen passing and re-passing continually, so that from May, or the beginning of June, according to the state of the season, they work continually, till the cold weather comes on.

The chief employment of the working ants, is in sustaining not only the idlers at home, but also finding a sufficiency of food for themselves. They live upon various provisions, as well of the vegetable as of the animal kind. Small insects they will kill and devour; sweets of all kinds

kinds they are particularly fond of. They seldom, however, think of their community, till they are first satisfied themselves. Having found a juicy fruit, they swallow what they can, and then, tearing it in pieces, carry home their load. If they meet with an insect above their match, several of them will fall upon it at once, and having mangled it, each will carry off a part of the spoil. If they meet in their excursions, with any thing that is too heavy for one to bear, and yet, which they are unable to divide, several of them will endeavour to force it along; some dragging and others pushing. If any of them happen to make a lucky discovery, it will immediately give notice to others; and then, at once, the whole republic will put themselves in motion. If in these struggles, one of them happen to be killed, some kind survivor will carry him off to a great distance, to prevent the obstructions his body may give to the general spirit of industry.

But while they are thus employed in supporting the state, in feeding abroad, and carrying in provisions to those that continue at home, they are not unmindful of posterity. After a few days of fine weather, the female ants begin to lay their eggs, and those are assidu-

ously

ously watched and protected by the working ants, who take upon themselves to supply whatever is wanting to the nascent animal's convenience or necessity. They are carried, as soon as laid, to the safest situation, at the bottom of their hill, where they are carefully defended from cold and moisture. We are not to imagine, that those white substances, which we find so plentifully in every ant hill, are the eggs as newly laid. On the contrary, the ant's egg is so very small, that, though laid upon a black ground, it can scarcely be discerned. The little white bodies which we see, are the young animals in their maggot state, endued with life, long since freed from the egg, and often involved in a cone, which it has spun round itself, like the silk worm. The real egg, when laid, if viewed through a microscope, appears smooth, polished, and shining, while the maggot is seen composed of twelve rings, and is often larger than the ant itself.

It is impossible to express the fond attachment which the working ants shew to their rising progeny. In cold weather they take them in their mouths, but without doing them the smallest injury, to the very depths of their habitation, where they are less subject to
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the severity of the season. In a fine day they remove them, with the same care, nearer the surface, where their maturity may be assisted by the warm beams of the sun. If a formidable enemy should happen to batter down their whole habitation, and crush them by thousands in the ruin, yet these wonderful insects, still mindful of their parental duties, make it their first care to save their offspring. They are seen running wildly about, different ways, each loaded with a young one, often bigger than the insect that supports it. "I have kept," says Swammerdam, "several of the working ants in my closet, with their young, in a glass filled with earth. I took pleasure in observing, that in proportion as the earth dried on the surface, they dug deeper and deeper to deposit their eggs; and when I poured water thereon, it was surprising to see with what care, affection, and diligence they laboured, to put their brood in safety, in the driest place. I have seen also, that when water has been wanting for several days, and when the earth was moistened after it a little, they immediately carried their young ones to have a share, who seemed to enjoy and suck the moisture."

When the young maggot comes to its full growth, the breast swells insensibly, it casts its skin, and loses all motion. All the members which were before hidden, then begin to appear; an aurelia is formed, which represents, very distinctly, all the parts of the animal, though they are yet without motion, and, as it were, wrapped up in swaddling clothes. When, at length, the little insect has passed through all its changes, and acquired its proper maturity, it bursts this last skin, to assume the form it is to retain ever after. Yet this is not done by its efforts alone, for the old ones very assiduously break open, with their teeth, the covering in which it is enclosed. Without this assistance the aurelia would never be able to get free, as De Geer often found, who tried the experiment, by leaving the aurelia to themselves. The old ones not only assist them, but know the very precise time for lending their assistance; for, if produced too soon, the young one dies of cold; if retarded too long, they are suffocated in their prison.

When the female has done laying, and the whole brood is thus produced, her labours, as well as that of the male, become unnecessary; and her wings, which she had but a short time before so actively employed, drop off. What becomes

becomes of her when thus divested of her ornaments is not well known, for she is seen in the cells some weeks after. The males, on the other hand, having no longer any occupation at home, make use of those wings with which they have been furnished by nature, and fly away, never to return, or to be heard of more. It is probable that they perish with cold, or are devoured by the birds, which are particularly fond of this petty prey.

In the mean time, the working ants having probably deposed their queens, and being deserted by the males, which served but to clog the community, prepare for the severity of the winter, and bury their retreats as deep in the earth as they conveniently can. It is now found, that the grains of corn, and other substances with which they furnish their hills, are only meant as fences to keep off the rigours of the weather, not as provisions to support them during its continuance. It is found generally that every insect that lives a year after it is come to its full growth, is obliged to pass four or five months without taking any nourishment, and will seem to be dead all that time. It would be to no purpose, therefore, for ants to lay up corn for the winter, since they lie during that time without motion, heaped upon each other, and

are so far from eating that they are utterly unable to stir. Thus, what authors have dignified with the name of a magazine, appears to be no more than a cavity, which serves for a common retreat when the weather forces them to return to their lethargic state.

What has been said with exaggeration of the European ant, is however true, if asserted of those of the tropical climates. *They* build an ant-hill with great contrivance and regularity; lay up provisions, and, as they probably live the whole year, submit themselves to regulations entirely unknown among the ants of Europe.

Those of Africa are of three kinds, the *red*, the *green*, and the *black*; the latter are above an inch long, and in every respect a most formidable insect. Their sting produces extreme pain, and their depredations are sometimes highly destructive. They build an ant-hill of a very great size, from six to twelve feet high; it is made of viscous clay, and tapers into a pyramidal form *. This habitation is con-

* These pyramids are ten, fifteen and sixteen feet high in Western Africa, of a red colour, and absolutely like well baked earth. Their bases are all from a hundred to a hundred and twenty square feet; it would be a curious and philosophical undertaking, to compare these pyramids with the celebrated ones of Egypt.

structed with great artifice; and the cells are so numerous and even, that a honey-comb scarcely exceeds them in number and regularity.

The inhabitants of this edifice seem to be under a very strict regulation. At the slightest warning they will sally out upon whatever disturbs them; and if they have time to arrest their enemy, he is sure to find no mercy. Sheep, hens, and even rats, are often destroyed by these merciless insects, and their flesh devoured to the bone. No anatomist in the world can strip a skeleton so clean as they; and no animal, however strong, when they have once seized upon it, has power to resist them.

It often happens that these insects quit their retreat in a body, and go in quest of adventures.

“ During my stay,” says Smith, “ at Cape
“ Corse Castle, a body of these ants came to
“ pay us a visit in our fortification. It was
“ about day-break when the advanced guard
“ of this famished crew entered the chapel,
“ where some negroe servants were asleep upon
“ the floor. The men were quickly alarmed
“ at the invasion of this unexpected army, and
“ prepared as well as they could for a defence.

“ While

“ While the foremost battalion of insects had
“ already taken possession of the place, the rear-
“ guard was more than a quarter of a mile dis-
“ tant. The whole ground seemed alive and
“ crawling with unceasing destruction. After
“ deliberating a few moments upon what was
“ to be done, it was resolved to lay a large train
“ of gunpowder along the path they had taken :
“ by this means millions were blown to pieces,
“ and the rear-guard perceiving the destruction
“ of their leaders, thought proper instantly to
“ return, and make back to their original ha-
“ bitation.”

The order which these ants observe, seems very extraordinary; whenever they sally forth, fifty or sixty larger than the rest are seen to head the band, and conduct them to their destined prey. If they have a fixed spot where their prey continues to resort, they then form a vaulted gallery, which is sometimes a quarter of a mile in length; and yet they will hollow it out in the space of ten or twelve hours.

Of the *Beetle* there are various kinds; all, however, concurring in one common formation of having cases to their wings, two in number; which are the more necessary to those insects,

as they often live under the surface of the earth, in holes which they dig out by their own industry. The cases prevent the various injuries their wings might sustain, by rubbing or crushing against the sides of their abode. These, though they do not assist flight, yet keep the internal wings clean and even, and produce a loud buzzing noise, when the animal rises in the air.

If we examine the formation of all animals of the beetle kind, we shall find, as in shell-fish, that their bones are placed externally, and their muscles within. These muscles are formed very much like those of quadrupeds, and are endued with such surprising strength, that bulk for bulk, they are a thousand times stronger than those of a man. This strength is of use in digging the animal's subterraneous abode, where it is most usually hatched, and to which it most frequently returns, even after it becomes a winged insect and capable of flying.

Besides the difference which results from the shape and colour of these animals, the size also makes a considerable one; some beetles being not larger than the head of a pin, while others, such as the elephant beetle, are as big as one's fist:

fist: but the greatest difference among them is, that some are produced in a month, and go through all the stages of their existence in a single season while others take nearly four years to their production; and live a year beyond in the state of winged insects.

The *May-bug* or *dorr-beetle*, as some call it, has, like all the rest, a pair of cases to its wings, which are of a reddish brown colour, sprinkled with a whitish dust, which easily comes off. In some, their necks are covered with a red plate, and in others with a black one. The fore legs are very short, and the better calculated therefore for burrowing in the ground where this insect makes its retreat. It is well known by its evening buzz, to children; but still more formidably introduced to the acquaintance of husbandmen and gardeners, for in some seasons, it swarms in such numbers, as to eat up every vegetable production.

The two sexes in the may-bug, are easily distinguished from each other, by the superior length of the tufts, at the end of the horns, in the male. They copulate in summer, and in that season join each other for a considerable time. The female being impregnated,
quickly

quickly sets about boring a hole to deposit her burthen; this she generally makes about half a foot deep, and in it she places her eggs, which are of an oblong shape, and bright yellow colour, and having covered them over, she leaves them.

In about three months after the eggs have been deposited in the earth, the contained insect begins to break its shell, and a small grub, or maggot, crawls forth, and feeds upon the roots of whatever vegetable happens to be nearest. All substances, of this kind, seem equally grateful, yet it is probable the mother insect has a choice among what kind of vegetables she shall deposit her young. In this manner, these voracious creatures continue in the worm state, for more than three years, devouring the roots of every plant they approach, and making their way under ground, in quest of food, with great dispatch and facility. At length they grow to above the size of a walnut, being a great thick white maggot with a red head, which is seen most frequently in new turned earth, and which is so greedily sought after by birds of every species.

When largest, they are found an inch and a half long, of a whitish yellow colour, with

a body consisting of twelve segments or joints, on each side of which there are nine breathing holes, and three red feet. The head is large, in proportion to the body, of a reddish colour, with a pincer before, and a semi-circular lip, with which it cuts the roots of plants, and sucks out their moisture. As this insect lives entirely under ground, it has no occasion for eyes, and accordingly it is found to have none; but is furnished with two feelers, which serve to direct its motions.

It is not till the end of the fourth year, that this extraordinary insect prepares to emerge from its subterraneous abode, and even this is not effected, but by a tedious preparation. About the latter end of autumn, the grub begins to perceive the approach of its transformation; it then buries itself deeper and deeper in the earth, sometimes six feet beneath the surface, and there forms a capacious apartment, the walls of which it renders very smooth and shining, by the excretions of its body. Its abode being thus completed, it begins soon after to shorten itself, to swell, and to burst its last skin, in order to assume the form of a crysalis. This, in the beginning, appears of a yellowish colour, which heightens by degrees, till, at last, it is
seen

seen nearly red. Its exterior form plainly discovers all the vestiges of the future winged insect, all the fore parts being distinctly seen; while behind, the animal is concealed.

The young may-bug continues in this state for about three months longer, and it is not till the beginning of January, that the aurelia divests itself of all its impediments, and becomes a winged insect, completely formed. Yet still the animal is far from attaining its natural strength, health, and appetite. It undergoes a kind of infant imbecility, and, unlike most other insects, which the instant they become flies, are arrived at their state of full perfection, the may-bug continues feeble and sickly. Its colour is much brighter than in the perfect animal; all its parts are soft, and its voracious nature seems, for a while to have entirely forsaken it.

About the latter end of May, these insects, after having lived for four years under ground, burst from the earth, when the first mild evening invites them abroad. They are at that time seen rising from their long imprisonment: and from living long only upon roots, and imbibing only the moisture of the earth, visiting the mildness of the summer air, choosing the sweetest vegetables for their banquet, and drinking the dew of the evening.

When the season is favourable for them, they are seen by thousands buzzing along, hitting against every object that intercepts their flight. The mid-day sun, however, seems too powerful for their constitutions; they then lurk under the leaves and branches of some shady tree; but the oak seems their most favourite food; there they lurk in clusters, and seldom quit the tree till they have devoured all its verdure. Their duration, however, is but short, as they never survive the season.

Of all the beetle kind, this is the most numerous: like them all other beetles are bred from the egg, which is deposited in the ground, and sometimes, though seldom in the barks of trees; they change into a worm; they subsist in that state by living upon the roots of vegetables, or the succulent parts of the bark round them. Some of the others, however merit notice for their peculiarities.

The *Tumble-dung*, as the Americans call it, is all over a dusky black, rounder than those animals are in general, and so strong, (though not much larger than the common black beetle,) that if one of them be put under a candlestick, it will move it backwards and forwards.

wards. There is no creature more laborious, either in seeking subsistence, or in providing a proper retreat for its young. They are endowed with sagacity to discover subsistence, by their excellent smelling, which directs them in flight to excrements just fallen from man or beast, on which they instantly drop, and fall unanimously to work in forming round balls or pellets thereof, in the middle of which they lay an egg. These pellets in September, they bury three feet deep in the earth, where they lie till the approach of spring, when the eggs are hatched, the nests burst, and the insects find their way out of the earth. They assist each other with indefatigable industry, in rolling these globular pellets to the place where they are to be buried. This they perform with the tail foremost, by raising up their hinder parts and shoving along the ball with their hind feet. They are always accompanied with other beetles of a larger size, and of a more elegant structure and colour. The breast of those is covered with a shield of a crimson colour, and shining like metal; the head is of the like colour, mixed with green, and on the crown of the head stands a shining black horn, bent backwards. These are called the

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the *kings of the beetles*, but why, is uncertain, since they partake of the same drudgery.

The *Elephant-beetle* is the largest of this kind hitherto known, and is found in South America, particularly Guiana and Surinam, as well as about the river Oroonoko. It is of a black colour, and the whole body is covered with a very hard shell, full as thick and as strong as that of a small crab. Its length, from the hinder part of the eyes, is almost four inches, and from the same part to the end of the proboscis, or trunk, four inches, and three-quarters. The transverse diameter of the body is two inches and a quarter, and the breadth of each elytron, or case for the wings, is an inch and three-tenths. The antennæ, or feelers, are quite horny; for which reason the proboscis, or trunk, is moveable at its insertion into the head, and seems to supply the place of feelers. The horns are eight tenths of an inch long, and terminate in points. The proboscis is an inch and a quarter long, and turns upwards, making a crooked line, terminating in two horns, each of which is near a quarter of an inch long; but they are not perforated at the end like the proboscis of other insects. About four tenths of
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an inch above the head, at that side next the body, is a prominence, or small horn, which, if the rest of the trunk were away, would cause this part to resemble the horn of a rhinoceros. There is indeed, a beetle so called, but then the horn, or trunk, has no fork at the end, though the lower horn resembles this.

In the *Glow-worm* species, no two insects can differ more from each other than the male and female. The male is in every respect a beetle, having cases to its wings, and rising in the air at pleasure; the female, on the contrary, has none, but is entirely a creeping insect, and is obliged to await the approaches of her capricious companions. The body of the female has eleven joints, with a shield breast-plate, the shape of which is oval; the head is placed over this, and is very small, and the three last joints of her body are of a yellowish colour; but what distinguishes it from all other animals, at least in this part of the world, is the shining light which it emits by night, and which is supposed by some philosophers to be an emanation, which she sends forth to allure the male to her company. If taken in the hand, this light will soon disappear.

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The *Cantharis* is of the beetle kind, whence is derived the appellation of cantharides, well known in the shops by the name of *Spanish Flies*, and for their use in blisters. They have feelers like bristles, flexible cases to their wings, a breast pretty plain, and the sides of the belly wrinkled. Cantharides differ from each other in their size, shape, and colour. The largest in these parts are about an inch long, and as much in circumference, but others are not above three quarters of an inch. Some are of a pure azure colour, others of pure gold, and others again, have a mixture of pure gold and azure colours: but they are all very brilliant and extremely beautiful. They are of the greatest benefit to mankind, making a part in many medicines conducive to human preservation. They are chiefly natives of Spain, Italy, and Portugal; but they are to be met with also about Paris in the summer time, upon the leaves of the ash, the poplar, and the rose-trees; and also among wheat, and in meadows, &c. Such numbers of them have sometimes been seen together in the air, that they appeared like swarms of bees, and they have so disagreeable a smell, that it may be perceived a great way off. This bad smell is a guide for those who make

it their business to catch them. When they are caught they dry them, after which they are so light, that fifty will hardly weigh a dram. Those that gather them, tie them in a bag, or a piece of linen cloth, that has been well worn, and then they kill them with the vapours of hot vinegar, after which, they are dried in the sun, and kept in boxes.

Another insect of great use in medicine, is the *Kermes*; it is produced in the excrescence of an oak, called the *berry-bearing ilex*, and appears at first wrapt up in a membraneous bladder, of the size of a pea, smooth and shining, of a brownish red colour, and covered with a very fine ash-coloured powder. This bag teems with a number of reddish eggs, or insects, which being rubbed with the fingers, pour out a crimson colour. It is only met with in warm countries in May and June.

In the month of April it becomes of the size and shape of a pea, and its eggs some time after burst from the womb, and soon turning into worms, run about the branches and leaves of the tree. The males are very distinct from the females, and are a sort of small flies like gnats, with six feet, of which the four forward

are short, and the two backward long, divided into four joints, and armed with three crooked nails. There are two feelers on the head, a line and a half long, which are moveable, streaked, and articulated. The tail is half a line long, and forked. The whole body is covered with two transparent wings, and they leap about in the manner of fleas.

An insect, perhaps, still more useful than either of the former, is the *Cochineal*. This is of a scarlet colour within, and without of a blackish red; it is of an oval form, of the size of a small pea, with six feet, and a snout or trunk. It brings forth its young alive, and is nourished by sucking the juice of the plant. Its body consists of several rings; and when it is once fixed on the plant, it continues immoveable, being subject to no change. Some pretend there are two sorts, the one domestic, which is best, and the other wild, which is of a vivid colour; they appear however to be the same, only with this difference, that the wild feeds upon uncultivated trees, without any assistance, whereas the domestic is carefully at a stated season, removed to cultivated trees, where it feeds upon a purer juice, and at the approach of

of winter they are taken within doors on the leaves of the prickly pear plant, which supplies them during the cold weather. When the weather becomes milder, and these animals are about to exclude their young, the natives make them nests, like those of birds, but less, of tree-moss, or soft hay, or the down of cocoa-nuts, placing twelve in every nest. These they fix on the thorns of the prickly pear-plant, and in three or four days time they bring forth their young, which leave their nests in a few days, and creep upon the branches of the plant, till they find a proper place to rest in.

When the native Americans have gathered the cochineal, they put them into holes in the ground, where they kill them with boiling water, and afterwards dry them in the sun, or in an oven, or lay them upon hot plates. From the various methods of drying them, arise the different colours which they present when brought to us. While they are living, they seem to be sprinkled over with a white powder, which they lose as soon as the boiling water is poured upon them. Those that are dried upon hot plates are the blackest. What we call the cochineal, are only the females, for the males are a sort of fly.

The *Gallinsects* (which, though not belonging to the beetle tribe, we know not where better to introduce,) are bred in a sort of bodies adhering to a kind of oak in Asia, which differ with regard to their colour, size, roughness, smoothness, and shape, and which we call galls. They are not fruit, as some have imagined, but preternatural tumours, owing to the wounds given to the buds, leaves, and twigs of the tree, by a kind of insects that lay their eggs within them. This animal is furnished with an implement, by which the female penetrates into the bark of the tree, or into that spot which just begins to bud, and there sheds a drop of corrosive fluid into the cavity. Having thus formed a receptacle for her eggs, she deposits them in the place, and dies soon after.

The juice, or sap of the plant, being by this means turned back from its natural course, extravasates and flows round the egg; after which, it swells and dilates into a kind of ball, by the assistance of some bubbles of air, which get admission through the pores of the bark, and which run into the vessels with the sap.

This little ball receives its nutriment, growth, and vegetation, like the other parts of the tree, by slow degrees, and is what we call the gall-

nut. The worm that is hatched under this spacious vault, finds, in the substance of the ball, a subsistence suitable to its nature; gnaws and digests it till the time comes for its transformation to a *nympha* or *chrysalis*, and from that state of existence, changes into a fly. After this the insect, perceiving itself duly provided with all things requisite, disengages itself from its confinement, and takes its flight into the open air. The cold weather, however, frequently comes on before the worm is transformed into a fly, or before the fly can pierce through its inclosure. The nut falls with the leaves, and the fly spends the winter in a warm house, where it is preserved from the injuries of the weather. This apartment however, though so commodious a retreat in the winter, is a perfect prison in the spring. The fly, roused out of its lethargy with the first heat, breaks its way through, and ranges where it pleases. A very small aperture is sufficient, since at this time it is but a diminutive creature. Besides, the ringlets of which its body is composed, dilate, and become pliant in the passage.

The

The *Gnat* and the *Tipula*, are two insects that entirely resemble each other in their form, and yet widely differ in their habits, manners, and propagation. The chief and only difference between them is, that the tipula wants a trunk, while the gnat has a large one, which it often exerts to very mischievous purposes.

The gnat proceeds from a little worm, which is usually seen at the bottom of standing waters. After having laid the proper number of eggs on the surface of the water, it surrounds them with a kind of unctuous matter, which prevents them from sinking; but at the same time fastens them with a thread at the bottom, to prevent their floating away from the place, the warmth of which is proper for their production, to any other where the water may be too cold, or the animal's enemies too numerous. As they come to maturity, they sink deeper, and at last, when they leave the eggs as worms, they creep along at the bottom. They then make themselves lodgments of cement, which they fasten to some solid body at the very bottom of the water, unless, by accident, they meet with a piece of chalk which being of a soft and pliant

pliant nature; gives them an opportunity of sinking a retreat for themselves, where nothing but the claws of a cray-fish can possibly molest them.— The worm afterwards changes its form. It appears with a large head, and a tail invested with hair, and moistened with an oleaginous liquor, which she makes use of as a cork, to sustain her head in the air, and her tail in the water, and to transform her from one place to another. When the oil with which her tail is moistened begins to grow dry, she discharges out of her mouth an unctuous humour, which she sheds all over her, by virtue whereof she is enabled to transport herself where she pleases, without being either wet, or any way incommoded by the water.

The gnat, in her next state, being divested of her second skin, resigns her eyes, her antennæ, and her tail; in short, she actually seems to expire. However, from the spoils of the amphibious animal, a little winged insect appears. Its head is adorned with a plume of feathers, and its whole body invested with scales and hair. The fur below, or little border of fine feathers, which graces its wings, is very curious; but there is nothing of greater importance to the gnat, than its trunk; and that

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weak instrument may justly be deemed one of Nature's master-pieces. It is so very small, that the extremity can scarcely be discerned through the best microscope. That part which is at first obvious to the eye, is nothing but a long scaly sheath under the throat. At the distance of nearly two-thirds of it, there is an aperture, through which the insect darts out four stings, and afterwards retracts them; one of which, however sharp and active it may be, is no more than the case in which the other three lie concealed, and run in a long groove. The sides of these stings are sharpened like two-edged swords; they are likewise barbed, and have a vast number of cutting teeth towards the point, which turns up like a hook, and is fine beyond expression. When the gnat, has tasted any fruit, flesh, or juice, with the point of its case, which it uses like a tongue: if it be a fluid, the animal sucks it up, without playing her darts upon it; but if there be any obstruction, it exerts its strength, and pierces through if possible. After this, it draws back its stings into their sheath, which it applies to the wound, in order to extract, as through a reed, the juices which it finds inclosed. In the winter the gnat ceases to eat,
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and spends all that season either in quarries, or in caverns, which it abandons at the return of summer, and flies about in search of some commodious ford, or standing water, where it may produce its progeny. The little brood are sometimes so numerous, that the very water is tinged according to the colour of the species, green, if they be green, and of a sanguine hue, if they be red.

However similar insects of the gnat kind are in their appearance, yet they differ widely from each other in the manner in which they are brought forth, for some are produced from eggs, while some are viviparous, and come forth at once in their full and perfect form.

A gnat separated from the rest of its kind, and inclosed in a glass vessel, with air sufficient to keep it alive, will produce young, which, also, when separated from each other, will be the parents of a numerous progeny. Thus, down for five or six generations, do these extraordinary animals propagate, without any union between the male and female, but, in the manner of vegetables, the young bursting from the body of their parents, without any previous impregnation. At the sixth generation, however, their propagation stops, the

gnat no longer produces its like, from itself alone, but it requires the access of the male to give it another succession of fecundity.

The gnat of Europe gives but little uneasiness; but it is very different in the regions of America, where the waters stagnate, and the climate is warm, and where they are produced in multitudes beyond expression. The whole air is there filled with clouds of those famished insects; and they are found of all sizes, from six inches long, to a minuteness that even requires the microscope to have a distinct perception of them. The warmth of the mid-day sun is too powerful for their constitutions; but when the evening approaches, neither art nor flight can shield the wretched inhabitants from their attacks; though millions are destroyed, millions still succeed, and produce unceasing torment.

The native Indians, who anoint their bodies with oil, sleep in their cottages covered all over with thousands of the gnat kind upon their bodies, and yet do not seem to have their slumbers interrupted by their cruel devourers. If a candle is lighted in one of those places, a cloud of insects, at once light upon the flame, and extinguish it; they are therefore obliged to keep their candles in glass lanthorns.

ZOOPHYTES.

THESE are supposed to be the last order of animated nature, or rather the link by which the animal and vegetable world are united. The gradations throughout the whole system, as Buffon has judiciously remarked, are by such imperceptible degrees that it would be impossible to say, positively, where the one begins and the other ends; particularly in this, as the sensitive plant, the fly-trap, &c. have more actual motion than the oyster, and others that are called animals. In the vegetable world the species may be continued by cutting a slip from a plant, and the same also may be done in this order, and a thousand perfect beings be formed by cutting one into as many pieces.

In the class of zoophytes, we may place all those animals, which may be propagated by

cuttings, or, in other words, which, if divided into two or more parts, each part in time becomes a separate and perfect animal; the head shoots forth a tail, and, on the contrary the tail produces a head; some of these will bear dividing into two parts, such as the earth-worm: some may be divided into more than two, and of this kind are many of the star fish; others may be cut into a thousand parts, each becoming a perfect animal; they may be turned inside out, like the finger of a glove, they may be moulded into all manner of shapes, yet still their vital principal remains, still every single part becomes perfect in its kind, and, after a few days existence, exhibits all the arts and industry of its parent.

The first in this class is the *Worm* kind, which, being entirely destitute of feet, trail themselves along the ground, and find a safe retreat under the earth, or in the water. As these, like serpents, have a creeping motion, so both, in general, go under the common appellation of reptiles; their manner of moving is, however, very different, for the worm has a power of contracting or lengthening itself at will. There is a spiral muscle,

muscle, that runs round its whole body, from the head to the tail, somewhat resembling a wire wound round, which, when one end is extended and held fast, will bring the other nearer to it; in this manner the earth-worm, having shot out, or extended its body, takes hold by the slime of the fore part of its body, and so contracts and brings forward the hinder part: and in this manner it moves onward, but not without considerable effort. Its body is armed with small stiff sharp burrs, or prickles, which it can erect or depress at pleasure; under the skin there lies a slimy juice, that is ejected as occasion requires, at certain perforations, between the rings of the muscles, to lubricate its body, and facilitate its passage into the earth. Like most other insects, it has breathing holes along the back, adjoining each ring; but it is without bones, without eyes, without ears, and, properly, without feet. It has a mouth, and also an alimentary canal, which runs along to the very point of the tail. In some worms, however, particularly such as are found in the bodies of animals, this canal opens towards the middle of the belly, at some distance from the tail. The intestines of the
earth-

earth-worm are always found filled with a very fine earth, which seems to be the only nourishment it is capable of receiving.

The animal is entirely without brain, but near the head is placed the heart, which is seen to beat with a very distinct motion, and round which are the spermatic vessels, forming a number of little globules, containing a milky fluid, which have openings into the belly, not far from the head: they are also found to contain a number of eggs, which are laid in the earth, and are hatched in twelve or fourteen days into life, by the genial warmth of their situation. Like snails, these animals are of both sexes, and like them impregnate, and are impregnated at the same time.

In about fourteen days the young ones come forth very small, but perfectly formed, and suffer no change during their existence: but how long their life continues is not well known, though it certainly continues for more than two or three seasons. During the winter, they bury themselves deeper in the earth, and seem, in some measure, to share the general torpidity of the insect tribe. In the spring, they revive with the rest of nature, and on those occasions, a
moist

moist or dewy evening brings them forth from their retreats, for the universal purpose of continuing their kind. They chiefly live in a light, rich, and fertile soil, moistened by dews or accidental showers, but avoid those places where the water is apt to lie on the surface of the earth, or where the clay is too stiff for their easy progression under ground.

Helpless as they are formed, yet they seem very vigilant in avoiding those animals that chiefly make them their prey; in particular, the mole, who feeds entirely upon them beneath the surface, and who seldom ventures, from the dimness of its sight, into the open air; him they avoid, by darting up from the earth, the instant they feel the ground move. They are also driven from their retreats under ground, by pouring bitter or acid water on it, such as the water in which green walnuts have been steeped, or a lye made of pot-ashes.

Some animals live without their limbs, and are often seen to re-produce them; some are seen to live without their brain for many weeks together; caterpillars continue to encrease and grow large, though all their nobler organs are entirely destroyed within; some animals continue to exist, though cut in two, their nobler parts

parts preserving life, while the others perish that were cut away; but the earth-worm; and all the zoophyte tribe, continue to live in separate parts, and one animal, by the means of cutting, is divided into two distinct existences, sometimes into a thousand.

Spalanzani tried several experiments upon the earth-worm, many of which succeeded according to his expectation; every earth-worm, however, did not retain the vital principle with the same obstinacy; some, when cut in two, were entirely destroyed; others survived only in the nobler parts, and, while the head was living, the tail entirely perished, and a new one was seen to bud from the extremity. But, what was most surprising in some, particularly in the small red-headed earth-worm, was that both extremities survived the operation: the head produced a tail with the anus, the intestines, the annular muscle, and the prickly beards; the tail part, on the other hand, was seen to shoot forth the nobler organs, and in less than the space of three months sent forth a head and heart with all the apparatus and instruments of generation. This part, as may easily be supposed, was produced much more slowly than the former, a new head taken above
three

three or four months for its completion, while a new tail is shot forth in less than as many weeks.

What was performed upon the earth-worm, was found to obtain also in many other of the vermicular species.

The *Sea-worm*, the *white water worm*, and many of those little worms with feelers, found at the bottom of dirty ditches. In all these the nobler organs are of such little use, that if taken away, the animal does not seem to feel the want of them; it lives in all parts, and in every part; and, by a strange paradox in nature, the most useless and contemptible life is of all others, the most difficult to destroy.

The next genus of zoophytes is that of the *Star-fish*, or *sea nettles*, a numerous tribe, shapeless and deformed, assuming, at different times, different appearances. All of this kind are formed of a semi-transparent, gelatinous substance, covered with a thin membrane, and often appearing like a lump of inanimate jelly. But, upon a more minute inspection, they will be found possessed of life and motion; they will be seen to shoot forth their arms in every direction,

rection, in order to seize upon such insects as are near, and to devour them with great rapacity. Worms, the spawn of fish, and even muscles themselves, with their hard resisting shells, have been found in the stomachs of these voracious animals: and what is very extraordinary, though the substance of their own bodies is almost as soft as water, yet they are no way injured by swallowing these shells, which are almost of a stony hardness. They increase in size as all other animals do. In summer, when the water of the sea is warmed by the heat of the sun, they float upon the surface, and in the dark they send forth a kind of shining light, resembling that of phosphorus.

They are often seen fastened to the rocks, and to the largest sea-shells, as if they derived their nourishment from them. If they be taken and put into spirits of wine, they will continue for many years entire; but if they be left to the influence of the air, they are in less than four and twenty hours, melted down into a limpid and offensive water.

In all this species, the same passage by which they devour their food, serves for the ejection of their fœces. It is impossible to describe them under one determinate shape; but, in general, their

their bodies resemble a truncated cone, whose base is applied to the rock to which they are usually found attached. Though generally transparent, yet they are of different colours, as green, red, white, and brown. In some, their colours appear diffused over the whole surface, in others they are streaked, and in others, often spotted. They are possessed of a very slow progressive motion, and in fine weather, they are continually seen, stretching out and fishing for their prey. Many of them are possessed of a number of long slender filaments, in which they entangle any small animals they happen to approach, and thus draw them into their enormous stomachs, which fill the whole cavity of their bodies. The harder shells continue for some weeks indigested, but at length they undergo a kind of maceration in the stomach, and become a part of the substance of the animal itself. The indigestible parts are returned by the same aperture by which they were swallowed, and then the star-fish begins to fish for more. These also may be cut in pieces, and every part will survive the operation; each becoming a perfect animal, endued with its natural rapacity. Of this tribe, the

number is various, but the manners and nature of all, are nearly as described.

The *Cuttle Fish*, or *sea-polypi*, is about two feet long, covered with a very thin skin, and its flesh is composed of a gelatinous substance, which however, internally, is strengthened by a strong bone, of which such great use is made by the goldsmiths. It is round at one end, and at the other has eight kind of arms, which it extends, and which are probably of service to it in fishing for its prey; while alive, it is capable of lengthening or contracting these at pleasure; they feed upon small fish, which they seize with their arms; and they are bred from eggs, which are laid upon the weeds along the sea shore.

The cuttle-fish is found along many of the coasts of Europe, but is not easily caught, from a contrivance with which they are furnished by nature; this is a black substance, of the colour of ink, which is contained in a bladder generally on the left side of the belly, and which is ejected in the manner of an excrement from the anus. Whenever, therefore, this fish is pursued, and when it finds a difficulty of escaping, it spurts forth a great quantity

tity of this black liquor, by which the waters are totally darkened; and then it escapes, by lying at the bottom.

The common *Polypus* is found at the bottom of wet ditches, or attached to the under surface of the broad-leaved plants that grow and swim on the waters. The same difference holds between these and the sea-water polypus, as between all the productions of the land and the ocean. The marine vegetables and animals grow to a monstrous size. It is the same between the polypi of both elements. Those of the sea are found from two to three or four feet in length, and Pliny has even described one, the arms of which were no less than thirty feet long. Those in fresh waters, are seldom above three parts of an inch long, and when gathered up into their usual form, not above a third of those dimensions.

Whoever has looked with care into the bottom of a wet ditch, when the water is stagnant, and the sun has been powerful, may remember to have seen many little transparant lumps of jelly, about the size of a pea, and flattened on one side: such also as have examined the under side of the broad leafed weeds that grow on the surface

surface of the water, must have observed them studded with a number of these little jelly-like substances, which were probably then disregarded, because their nature and history was unknown. These little substances, however, where no other than living polypi gathered up into a quiescent state, and seemingly inanimate, because either undisturbed, or not excited by the calls of appetite to action. When they are seen exciting themselves, they put on a very different appearance from that when at rest; to conceive a just idea of their figure, we may suppose the finger of a glove cut off at the bottom; we may suppose also several threads or horns planted round the edge like a fringe. The hollow of this finger will give us an idea of the stomach of the animal; the threads issuing forth from the edges may be considered as the arms or feelers, with which it hunts for its prey. The animal is furnished neither with muscles nor rings, and its manner of lengthening or contracting itself more resembles that of the snail than worms, or any other insect. Warmth animates them, and cold benumbs them; but it requires a degree of cold approaching congelation, before they are reduced to perfect inactivity; those of an inch long
have

have generally their arms double, often thrice as long as their bodies. The arms, where the animal is not disturbed, and the season not unfavourable, are thrown about in various directions, in order to seize and entangle its little prey; sometimes three or four of the arms are thus employed, while the rest are contracted like the horns of a snail, within the animal's body. It seems capable of giving what length it pleases to these arms; it contracts and extends them at pleasure, and stretches them only in porportion to the remoteness of the object it would seize.

These animals have a progressive motion, which is performed by that power which they possess of lengthening and contracting themselves at pleasure; they mount along the margin of the water, and climb up the side of aquatic plants. They are often seen to come to the surface of the water, where they suspend themselves by their lower end. As they advance but very slowly, they employ a great deal of time in every action, and bind themselves very strongly to what ever body they chance to move upon as they proceed; their adhesion is voluntary, and is probably performed in the manner of a cupping-glass applied to the body.

All

All animals of this kind have a remarkable propensity to turn towards the light, and this might induce an enquirer to look for their eyes; but nothing that has the smallest resemblance to this organ was ever found over the whole body.

In the centre of the arms, the mouth is placed, which the animal can open and shut at pleasure, and this serves at once as a passage for food, and an opening for it after digestion. The inward part of the body seems to be one great stomach, which is open at both ends; but the purposes which the opening at the bottom serves are hitherto unknown, but certainly not for excluding their excrements. The surface of the body is studded with a number of warts; as are also the arms, especially when they are contracted.

These insects chiefly subsist upon others that are less than themselves: particularly a kind of millipeds that live in the water, and a very small red worm. No insect whatever, less than themselves, seems to come amiss to them. Wherever their prey is perceived, which the animal effects by its feeling, it is sufficient to touch the object it would seize upon, and it is fastened without a power of escaping. The greater the distance at which it is touched, the greater is the ease with which

which the polypus brings the prey to its mouth. When it has seized upon its prey, it then opens the mouth distinctly, and this opening is always in proportion to the size of the animal which it would swallow; the lips dilate insensibly by small degrees, and adjust themselves precisely to the figure of their prey. Mr. Trembly, who took a pleasure in feeding this useless brood, found that they could devour aliments of every kind, fish and flesh as well as insects; but he owns that they did not thrive so well upon beef and veal, as upon the little worms of their own providing.

Two of them are often seen seizing the same worm at different ends, and dragging it in opposite directions with great force. It often happens that while one is swallowing its respective end, the other is also employed in the same manner, and thus they continue swallowing each his part, until their mouths meet together; they then rest, each for some time in this situation, till the worm breaks between them, and each goes off with his share; but it often happens, that a seemingly more dangerous combat ensues, when the mouths of both are thus joined upon one common prey together: the largest polypus then gapes and swallows his antagonist, but

what is very wonderful, the animal thus swallowed, seems to be rather a gainer by the misfortune. After it has lain in the conqueror's belly for about an hour, it issues forth unhurt, and often in possession of the prey which had been the original cause of contention.

These reptiles continue eating the whole year, except when the cold approaches to congelation, and then, like most others of the insect tribe, they feel the general torpor of nature, and all their faculties are for two or three months suspended; but if they abstain at one time, they are proportionally voracious at another, and the meal of one day suffices them for several months together.

Their manner of propagation, or rather multiplication, has been for some years the astonishment of all the learned of Europe. They are produced in as great a variety of manners as every species of vegetable. Some polypi are propagated from eggs, as plants are from their seed; some are produced by buds issuing from their bodies; and all may be multiplied by cuttings.

If a polypus be carefully observed in summer, when these animals are chiefly active, and more

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particularly prepared for propagation, it will be found to protrude, from different parts of its body, several tubercles, or little knobs, which grow larger and larger every day; after two or three days inspection, what at first appeared but a small excrescence, takes the figure of a little animal, entirely resembling its parent, furnished with feelers, a mouth, and all the apparatus for seizing and digesting its prey. This diminutive creature every day becomes larger like the parent, to which it continues attached; it spreads its arms to seize upon whatever insect is proper for aliment, and devours it for its own particular benefit; thus it is possessed of two sources of nourishment, that which it receives from the parent by the tail, and that which it receives from its own industry by the mouth. The food which these animals receive, often tinctures the whole body, and upon this occasion the parent is often seen communicating a part of its own fluids to that of its progeny that grows upon it; while, on the contrary, it never receives a tincture from any substance that is caught and swallowed by its young. Several young ones are thus seen at once, of different sizes, growing from its body.

But, what is more extraordinary, those young ones themselves, that continue attached to their parent, are seen to protrude, and propagate their own young ones also, each holding the same dependence upon its respective parents, and possessed of the same advantages that have been already described in the first connection.

This seems to be the most natural way by which these insects are multiplied, for their production from the egg is not so common; and though some of this kind are found with a little bladder attached to their bodies, which is supposed to be filled with eggs, yet the artificial method of propagating them, is much more expeditious, and equally certain: it is indifferent whether one of them be cut into ten, or ten hundred parts, each becomes as perfect an animal as that which was originally divided.

Besides these kinds mentioned by Mr. Trembly, there are various others which have been lately discovered, by succeeding observers, and some of them so strongly resemble a flowering vegetable in their forms, that they have been mistaken by many naturalists for such.

Mr. Hughes, the author of the *Natural History of Barbadoes*, has described a species of this animal, but has mistaken its nature, and called

called them a sensitive flowering plant; he observed it to take refuge in the holes of rocks, and, when undisturbed, to spread forth a number of ramifications, each terminated by a flowery petal, which shrunk at the approach of the hand, and withdrew into the hole, whence before it had been seen to issue. This plant, however was no other than an animal of the polypus kind, which is not only to be found in Barbadoes, but also on many parts of the coast of Cornwall, and along the shores of the Continent.

A very minute race of the polypi species have also been found to cover what is called the *Coral Plant*, which is in such abundance all along the shores of the Persian gulph, the whole extent of the Red Sea, and the western coasts of America. These have excited the attention of several philosophers, and a variety of opinions have been thrown out concerning them, or rather as to the nature of the substance on which they are found; some confidently affirming it to be an aquatic plant, and that myriads of these insects being found on it, is not in the least singular, as there are many vegetables on earth equally covered by multitudes of living creatures, so small as to require a microscope to distinguish them. Others, on the contrary, pretend

pretend to prove, that neither the coral nor the sponge can belong to the vegetable kingdom, but that they are entirely the formation of these little animals, who construct them for their habitations and convenience, as bees do the honey-comb.

Without pretending to decide this question, we must confess our doubts of the latter opinion, and consider all the ingenious experiments that have been made as mere conjectures, drawn, certainly from analogy; but surely theories founded upon conjecture ought to be received with caution; it is upon facts alone that Naturalists should determine; and of those there are enough to make us reflect with admiration on the works and will of the Divine Being, who (we have shewn through the course of this work) has so closely united the different classes of the creation, as to form one universal machine, which is as wonderful in itself, and as far beyond our power to develop as He is in might and wisdom above our conception!

FINIS.

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